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# ANNUAL REPORT

OF THE

# INDIAN COUNCIL OF AGRICULTURAL RESEARCH

FOR

1957-58

RAM
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## SUMMARY

This is the 28th Annual Report of the I.C.A.R., giving a general review of the activities of the Council during the year 1957-58.

There were certain changes in personnel during the year under report. Shri L. Sahai took over as Animal Husbandry Commissioner with the Government of India. Shri J.V.A. Nehemiah was transferred to the Department of Agriculture and Shri S.K. Mirchandani and Shri J.S. Bali were appointed as Secretary and Additional Secretary respectively.

The Council sanctioned 52 new schemes involving an expenditure of Rs. 27·87 lakhs and also the continuation of 89 current schemes at a cost of Rs. 41·20 lakhs. Thirty-two schemes terminated during the year.

Following a recommendation of the Advisory Board of the Council, a Research Workers' Conference on Genetics and Breeding as applied to Plants and Animals, was held for the first time at Delhi in May 1957.

A brief account of the progress of research work in various fields of agriculture and animal husbandry is given below :

### AGRICULTURE

**Agronomy**—The co-ordinated investigations in regard to green-manuring of various crops were continued at different centres. For wheat, it was found that a forage legume (lucerne) preceding the staple crop gave better results from the economic point of view, than a green-manuring legume did. A new set of coordinated schemes on a model pattern for the local manufacture of pure medicines is now, in operation in Assam, Bombay, Madhya Pradesh, Punjab and Himachal Pradesh. Weedicidal trials on specific weeds like nut-grass, *kans* and *Lantana* were undertaken. It has been confirmed at Bose Institute that broad-leaved weeds are generally more susceptible to the 2, 4-D group of chemicals than the narrow-leaved ones are.

The Indo-American programme of fertilizer demonstrations which was started in 1954, concluded in 1957. The object of the scheme was to bring home to the farmer the value of chemical fertilizers as plant food, and to introduce to him the new fertilizers which are to be produced in India. More than 600,000 demonstrations were conducted all over India, during the three years.

The coordinated Scheme of Fertilizer Trials on Cultivators' Fields, the object of which is to estimate the average response to fertilizers in a given tract so that suitable manurial schedules may be drawn up, was sanctioned in July 1957 for 150 districts, out of a total of 200 selected under the scheme.

Under the Model Agronomic Experiments Scheme, financial sanction was issued for 33 centres.

**Soil Science**—Under the scheme for the survey of the micro-flora of soils in relation to their structure and the role of earth-worms in the micro-flora of soils, counts of bacteria action mycetes and moulds, physiologically active groups of micro-organisms in soil and dry aggregate and mechanical analysis of soil data have been made at the Indian Institute of Science, Bangalore.

**Vegetables**—In order to effect all-round improvement in vegetables, investigations relating to varietal tests, cultural practices and breeding for better varieties were carried out in the Punjab, Himachal Pradesh, Uttar Pradesh, Andhra Pradesh, Bombay, West Bengal, Jammu and Kashmir and Delhi. Considerable work was done at the Banaras Hindu University on tomato in the scheme for the increase of vegetable production by the use of hydroponics and hormones.

A conference of jute-growing States was convened in January, 1957, at New Delhi, to consider measures to accelerate the pace for the achievement of the target for jute fixed under the plan.

A scheme for the survey of indigenous implements which have not already been surveyed was sanctioned from April 1958.

### ANIMAL HUSBANDRY

**Cattle Breeding**—The schemes to assess the relative value of selective breeding of indigenous cattle *vis-a-vis* their grading up with improved breeds continued to operate in Orissa, Bihar and West Bengal.

**Sheep and Wool Development**—Based on the results of past work, the Council has now launched a coordinated scheme under the Second Five Year Plan for the development of sheep and wool. So far, 128 centres out of the 396 proposed, have been set up in different States.

**Disease Control**—Schemes for investigation of the diseases of cattle and buffaloes, sheep, goats and poultry, as well as a number of schemes on specific disease problems continued to function in the States and at the Indian Veterinary Research Institute, Mukteswar and Izatnagar.

**Dairying**—A scheme was started at Anand in September 1957 to evolve suitable measures for improving the keeping quality of milk and milk products. The effects of atmospheric temperature and humidity during winter, summer and monsoon on the bacteriological quality of raw milk were studied.

**Animal Nutrition**—Under the scheme for studying the problems of animal nutrition on a region-wise basis, the Council had established three regional stations at Haringhata, Anand and Bangalore in 1954. A Centre for the Northern Region, in Punjab, has now been sanctioned.

**Cattle Sterility**—The coordinated cattle sterility scheme was extended so as to include five more centres at the veterinary colleges in the States of Orissa, Andhra Pradesh, Madhya Pradesh, Kerala and Assam. The officers recruited for these centres were sent to Sweden for advanced training.

## STATISTICAL RESEARCH

The Statistical Wing of the Council continued its Advisory work relating to the design of agricultural and animal husbandry experiments and the interpretation of their results, and examination of technical programmes and annual reports of the Council's scheme.

Data pertaining to experiments carried out under the Coordinated Agronomical Experiments Scheme were analysed.

About 35 seminars were held on subjects of current statistical interest and on the investigations in progress at the Statistical Wing.

## EXTENSION AND EDUCATION

Good progress was made during the year in the construction of eight new agricultural and veterinary colleges, and in the expansion of existing nine colleges. Financial assistance is also being provided to State Governments for running a two-year short course in veterinary science.

Following a recommendation of the Joint Indo-American Team on Agricultural Research and Education, it has been decided to give financial assistance for starting post-graduate courses at eight agricultural and veterinary colleges.

In pursuance of a recommendation of the Indian Council of Agricultural Education, two seminars for teachers on teaching methods were held at Trivandrum and Mussoorie in May 1957 and May 1958, respectively.

Under the Indo-U.S. Technical Cooperation Programme, five Land Grant Colleges in the U.S.A. have agreed to assist agricultural research and education institutions in India by providing laboratory equipment and library books and arranging exchange of staff personnel.

The Agricultural Extension Advisory Committee continued its work of compiling detailed notes on the major crops for distribution to the extension personnel.

## AGRICULTURAL INFORMATION

The Council's scientific as well as popular journals continued to be published regularly. In addition, 13 publications under the Research and Review Series, 23 Farm Bulletins and 15 leaflets and pamphlets were brought out.

The Council supplied agricultural information literature worth Rs. 6,60,000 to the N.E.S. Blocks. Twelve exhibitions were organised in the country under the Exhibition Scheme, which aims at popularizing improved farming practices in the villages. The Council has set up a film production unit for the production of agricultural-instructional films for the benefit of farmers, extension workers and research workers.

A detailed account of the research and other activities of the Council is given in the following pages.

CHAPTER I

## ADMINISTRATION

This is the 28th Annual Report of the Indian Council of Agricultural Research presented by the Governing Body under Rule 64 of the rules of the Council, giving a general review of the activities of the Council during the year 1957-58.

### OFFICIAL CHANGES

During the year under report Shri L. Sahai took over as Animal Husbandry Commissioner with the Government of India *vice* Shri P.N. Nanda who retired.

Dr. P.M. Naidu relinquished charge of the post of Deputy Animal Husbandry Commissioner.

Shri J.V.A. Nehemiah, Secretary, was transferred to Department of Agriculture on his appointment as Extension Commissioner, and Shri S.K. Mirchandani and Shri J.S. Bali were appointed Secretary and Additional Secretary, I.C.A.R., respectively.

### ALLOTMENT OF FUNDS

The Council sanctioned the continuance of 89 current schemes at a cost of Rs. 41·20 lakhs (Appendix I). During the year it also sanctioned 52 new research schemes involving an expenditure of Rs. 27·87 lakhs (Appendix II). Thirty-two schemes terminated during the year (Appendix III).

### FINANCE AND ACCOUNTS

The following were the receipts from (*i*) the cess levied under the Agricultural Produce Cess Act, 1940, (*ii*) the grants received from the Government of India, and (*iii*) grants from other sources:—

| | Rs. |
|---|---|
| I. Receipts from the Cess .. .. .. .. | 39,79,230 |
| II. Grants from the Government of India— | |
| 1. Publication of a monograph entitled 'Rice in India' | 13,339 |
| 2. Setting up of Display Advisory Service, I.C.A.R. .. | 30,000 |
| 3. Supply of Agricultural Information literature to village level workers etc. of N.E.S. Blocks .. .. | 7,00,000 |
| 4. Scheme for production of campaign materials and training of State personnel .. .. .. | 30,000 |
| 5. Improvement of Land Records and Agricultural Statistics during 1957-58 .. .. .. | 11,000 |
| 6. Research and development of Pepper and Cashewnut | 53,000 |
| 7. Manurial and Agronomic Trials .. .. .. | 3,00,000 |
| 8. Production of Agricultural Instructional Films .. | 75,000 |
| 9. Scheme for ascertaining the cost of milk production .. | 48,000 |
| 10. Coordinated Cattle Sterility Scheme .. .. | 25,900 |

| | |
|---|---|
| 11. Sample Survey for the estimation of area and yield of Pepper .. .. .. .. .. | 33,750 |
| 12. Rinderpest Eradication Scheme—Preparation of propaganda material .. .. .. .. | 40,000 |
| 13. Scheme for the study of milk yield breeds and management practices of bovines in the Eastern regions .. | 85,000 |
| III. Grants from other sources— | |
| Co-operative Film Production Unit, Orissa .. .. | 60,000 |

A Statement showing the audited accounts of the Council for 1956-57, is appended (Appendix XV).

**MEETINGS**

The following meetings were held during the year.

| Name of the Body | No. of Meetings |
|---|---|
| (*i*) Working Party on Agriculture .. .. .. | |
| (*ii*) Working Party on Animal Husbandry .. .. | 1 |
| (*iii*) Board of Research .. .. .. .. | 1 |
| (*iv*) Advisory Board .. .. .. .. | 1 |
| (*v*) Standing Finance Committee .. .. .. | 1 |
| (*vi*) Governing Body .. .. .. .. | 1 |
| (*vii*) Annual General Meeting .. .. .. | 1 |
| (*viii*) Special General Meeting .. .. .. | 1 |
| (*ix*) Research Workers' Conference .. .. .. | 1 |

**RESEARCH WORKERS' CONFERENCE**

The Advisory Board recommended at its meeting held in January, 1956 that in addition to the usual conferences of specialists in particular fields there should also be annual conferences of Research Workers at suitable places so that they may exchange views and ideas on common problems. The Governing Body accepted this recommendation at its meeting held in February, 1956. The first Research Workers' Conference on "Genetics and Breeding as applied to Plants and Animals", was held at the Indian Agricultural Research Institute from the 23rd to 25th May, 1957. The Conference was attended by Research workers working in the different fields of agriculture and animal husbandry in the country. The following are some of the more important recommendations of the Conference:

1. There should be better and closer co-ordination between plant and animal geneticists, and that such joint meetings should be held more frequently in future.
2. Planning and implementation of research projects should be done on a collaborative basis.

3. Research on genetic improvement, pasture and forage grasses and legumes also be strengthened and planned with the cooperation of plant breeders, animal husbandrymen and forest grassland experts.

4. In view of the importance of hybrid vigour for the improvement of both plants and animals, a fuller and more systematic application of it to plant and animal breeding be made.

Other recommendations related to improvement in training of officials and dissemination of information about plant and animal genetics.

CHAPTER II

## AGRICULTURAL RESEARCH

As in previous years, the State Governments, Central Research Institutes, Commodity Committees etc. submitted technical reports on the work done by them during 1956-57. A brief summary of these is given below.

### AGRONOMY

**Agricultural Meteorology**—Scheme for developing techniques for the study of water requirements of crops was in progress at the Central Agricultural Meteorological Observatory, Poona. Evapo-transpiration loss was determined by the turbulence and volumetric methods, utilising the electronic equipment developed.

In the All India Phenological Scheme, data pertaining to the dates of flowering, fruit-setting, maturity of fruits and harvest for mango, tamarind, neem and babul trees were collected from 359 stations during the year.

In the All India Co-ordinated Crop-Weather Scheme, systematic observations, covering the growth and yield of paddy, wheat, jowar, sugarcane and cotton crops, including the incidence of diseases and pests as well as the meteorological factors significant for the crops during their life-cycle, continued to be recorded on a uniform basis at selected experimental farms.

**Green Manure**—Co-ordinated investigations on a uniform pattern and on various aspects of green manuring were in operation in Andhra Pradesh (at Rajindernagar since 1955), Bihar (at Sabour since 1953), Bombay (Poona since 1956), Himachal Pradesh (at Mandi since 1954), Mysore (at Mandya since 1955) at the Jute Research Institute Barrackpore (from 1953 to 1957) and at C.R.R.I., Cuttack (since 1953). The scheme at J.R.I., Barrackpore terminated in 1957. The results are briefly mentioned below—

Specialised Types of Green Manure Plants—Green manure types, *viz.*, *Sesbania macrocarpa*, *S. sericea*, *Dhaincha*, *Sunnhemp*, *Sesbania speciosa*, *Aeschynomene americana*, Blackgram, and Cowpea were found to be drought resistant at Cuttack. These gave more than 5,000 lb. per acre of green matter within eight weeks. Similarly, *Sesbania* species, *Aechynomene americana*, *Phaseolus semi erectus*, *Cassia tora*, and *C. mimosoides* were found resistant to water-logging, and in spite of the standing water in the field, produced more than 3,000 lb. of green matter per acre within eight weeks of sowing at Cuttack.

Green Manuring of Rice—Cowpea and Dhaincha either alone or with lime were tried out apropos Mustard cake, F.Y.M., compost and sludge at the Jute Agricultural Research Institute, Barrackpore. On an average, paddy green manured with Dhaincha gave the highest yield (of 31·77 md. per acre). Addition of lime to green manure crops at the time of incorporation, tended to depress the paddy yield. Fertilisers added direct to paddy gave 27·21 md. grain per acre as against 22·8 md. per acre.

*Sesbania seriacea*, *S. macrocarpa*, *Sesbania speciosa*, *Dhaincha*, Blackgram, Cowpea, and *Mung*, when sown from May-July, provided sufficient quality of green matter (5,000 lbs. per acre) for the early-planted rice crop at Cuttack. Besides these, *Crotalaria usaramoensis*, *Aeschynomene americana*, *Phaseolus semierectus* and *Cassia leschenaultiana* were also found suitable for latter plantings. For the manuring of the second season rice crop (planted in January), *Sesbania sericca*, *S. Macrocara*, *Dhaincha Sesbania speciosa*, Sunnhemp, and *Crotalaria usaramoensis*, Cowpea and *Mung*, provided more than 4,000 lb. of green matter per acre when sown between November and January. *Gliricidia maculata* was very useful for green leaf manuring and provided a perennial supply of green matter (30 to 45 lb. per plant) for manuring the rice crop in both the seasons.

In an experiment, at Jogindernagar in Himachal Pradesh, for the determination of the potentialities of the various leguminous species (*i.e.*, *Senji*, *Melitolus parviflora*) at 48 srs. per acre, Berseem (*Trifolium alexandrinum*) at 10 srs. per acre Matri (*Lathyrus aphace*) at 36 srs. per acre, Peas (*Pisum sativum*) at 40 srs. per acre, Lucerne (*Medicago stativa*) at 9 srs. per acre, Metha (*Trigonella foenumgracum*) at 20 srs. per acre, and Shaftal (*Trifolium resupinatum*) at 6 srs. per acre, significant difference was found in the yield of green matter produced by different species of crops. The plant in the order of yield of green matter were Shaftal, Berseem, Matri, Peas, Lucerne, Senji and Metha. The increase in paddy yield due to burying in of the green matter was the maximum in the case of berseem; legumes which came next were Shaftal, Peas, Matri, Lucerne, Senji, and Metha. There was significant effect of green matter plus super-phosphate (20 to 30 lb. $P_2O_5$) on the yield of paddy.

In the experiment to find out whether *mung* crop buried in after seeding and harvest was as efficacious as *mung* crop buried in at flowering, it was found at Cuttack that the latter method resulted in significant increase in the yield of rice over the former, the increase being 380 lb. per acre. But, $P_2O_5$ (30 lb. per acre) applied to *mung* or rice did not result in any significant increase in yield. N.P. Experiments were carried out to test the significance of the difference in paddy yield due to different sunnhemp treatments (*i.e.*, sunnhemp plants applied cut, sunnhemp buried *in situ*, stubbles of sunnhemp, and no manure) at Sabour, Bihar. The treatment of sunnhemp buried *in situ* gave significantly higher paddy yield as compared to no manure and sunnhemp plants only. N.P. differences in paddy yield at Sabour, Bihar, due to the effect of *Sesbania aculeata* (sown at 8, 12, and 16 seers per acre) were found to be significant (*i.e.*, yielding 17·89, 16·90, and 17·93 md. of paddy per acre) compared to control (yielding only 14·10 md. per acre). But differential seed rate did not effect the paddy yield significantly. N.P. as in previous years, at C.R.R.I., Cuttack, *Crotalaria* sp. (i.e., *C. usarmaoensis* and *C. brownei*) gave higher nitrogen content (i.e., 4,554 and 4,960 per cent. on dry weight) which is nearly double of *Dhaincha* (i.e., 2,792 per cent.). The carbon content at the 8 to 10 week stage was higher in those varieties that became woody at that stage. *Sesbania speciosa*, Sunnhemp, *Dhaincha*, and *Cassia tora* which tend to be semi-woody even at the 8-week stage recorded high percentage of carbon and correspondingly wider C/N ratio (14·70, 13·45, and 14·50 respectively).

In the investigations at Cuttack with *Dhaincha* of different ages, it was found that *Dhaincha* which was more succulent when 8 weeks old can be ploughed under at planting, while it became woody when 12 weeks old and required to be buried under, about 8 weeks, in advance of planting. Rice crop following 8 week-old *Dhaincha* buried at planting gave 2,235 lb. per acre while similar yield responses (2,242 lb. per acre) were obtained, when 12 week-old *Dhaincha* was buried in 8 weeks before planting of rice crop 9 N.P. In experiments at Mandya, Mysore, to study the effect of pure crops of cowpea, horsegram, green gram and sunnhemp individually and also mixed with 10, 25 and 50 per cent. of seed of sunnhemp as green manure on subsequent crop gave the highest yield of paddy (i.e., 4,100 lbs. per acre). The yield obtained by mixture of the three crops (i.e., cowpea, horsegram and green gram) and 10 per cent. or 25 per cent. of sunnhemp is practically the same (i.e., 3,425, 3,300, and 2,950 lb. per acre) respectively, but significantly higher than the yield obtained without green manure.

*Sesbania speciosa* was very promising for sowing in the standing rice crop at Cuttack and gave (when sown in November) on the main season rice crop and (in April) on the second season crop, 20,000 and 14,000 lb. of green matter respectively, for incorporation in Rice crop (in only-High).

Experiments were conducted at Jogindernagar, Himachal Pradesh to find out the possibilities of growing certain species of leguminous plants after harvesting wheat or linseed crops and the comparative effect of the application of super-phosphate at 0 and 30 lb. $P_2O_5$ per acre on these species and on the yeild of paddy to be transplanted in the plots green manured with different leguminous plants. It was found that sunnhemp, closely followed by cowpea, gave the best yield of green manure, while *mung* gave the least. Application of phosphate increased the yield of green matter significantly, but the interaction between phosphate and species was not significant. On the other hand, plots green manured with *mung* gave the best yield of paddy, closely followed by those green manured with sunnhemp and the cowpea. Though phosphate increased the yield of paddy significantly, interaction of phosphate and species was not significant.

In an experiment at C.R.R.I. to compare the efficiency of *Dhaincha* and sunnhemp when grown *in situ* or brought from outside, in combination with lime, phosphate and ammonium sulphate, both *Dhaincha* and sunnhemp gave identical yield response; there was no significant difference between the crop grown *in situ* and those brought from outside. The addition of lime, phosphate or ammonium sulphate (30 lb N. per acre) over the basal dressing of green matter did not show any significant response. However, with the combination of 30 lb. N. and 50 lb. $P_2O_5$, the green matter gave significant increase in yield of the succeeding rice crop, over the crop where nitrogen alone was applied without phosphates (the corresponding yields being 2,907 lb. and 2,570 lb. per acre respectively).

Green Manuring of Wheat—Nitrogen-fixing and fertilising ability of five green manure legumes (sunnhemp, velvet bean, blackgram, cowpea and greengram) and a forage legume (lucerne) was studied at Poona by growing them in *kharif* followed by dry irrigated crops of wheat in the *rabi* season. No significant differences were observed in nitrogen fixing ability of *kharif*

crops, in the case of dry wheat. However, the yield of wheat grain decreased significantly due to green manuring of sunnhemp and blackgram in *kharif*. Other treatments were statistically similar. From the economic point of view, a forage legume (lucerne) followed by wheat was more profitable than a green manuring legume followed by wheat. The former rotation fetched an extra income of Rs. 125 per acre approximately. 9 N. P. Wheat yield due to the following treatments, *viz.*, (*i*) crop buried *in situ*, (*ii*) plants applied cut, and (*iii*) stubbles of different green manuring crops (*viz.*, *Sesbania speciosa*, *Sesbania aculeata*, *Indigofera barbada*, Sunnhemp, and *Aschynomene americana*) were found to differ significantly among themselves at Sabour, Bihar. Treatment with *Sesbania aculeata* and Sunnhemp buried *in situ* and *S. aculeata* stubbles significantly out-yielded the control. The respective yields of wheat were 19·09, 18·70, and 17·14 md. per acre respectively. During the previous year sunnhemp *in situ* and *S. aculeata* stubbles did not differ significantly between themselves but significantly out-yielded the control. (iv) Green Manuring—the yield of jute fibre was to a certain extent lessened when green manuring crop (*i.e.*, sunnhemp, *Dhaincha*, blackgram and cowpea, etc.) is grown in jute fields at the early stages of the crop, at the Jute Agricultural Research Institute, Barrackpore. Green Manuring crops when grown between wider rows (18 × 24 in.) appeared to give higher yield of green matter than when grown in narrower rows (*i.e.*, 12″).

**Weeds and their Control**— Co-ordinated research schemes were in operation at the National Chemical Laboratories, Poona (from 1953 to 1957 for the local manufacture of pure Weedicides) in the Bose Institute, Calcutta (from 1953 to 1958), and in Madras (at Coimbatore from 1952 to 1956) for evolving proper weedicidal schedules. These schemes have been completed, and a new set of co-ordinated schemes on a model pattern is now in operation in Assam (at Jorhat since 1957), Bombay (at Nagpur since 1955), Madhya Pradesh (at Bhopal since 1955), Punjab (at Ludhiana since 1957) and in Himachal Pradesh (at Chhabra since 1954). The conclusions from the final reports of the first batch of schemes and from the current years results of the later batch are briefly summed up below:—

Crop Weeds—Water hyairnth etc. in rice fields *carvolrvlus* etc. in wheat, *Arotis menthotani*, etc. in *jowar*, *Striga*, etc. in cotton, were the serious weeds in Nagpur, Bombay State.

Manufacture of Weedicides—In the scheme (in operation from 1953-57) at the National Chemical Laboratory, Poona, to manufacture, suitable hormone types of herbicide, the following weedicides were produced:—

About 70 lb. of 2, 4-D as sodium salt was prepared by first producing 2, 4-D ichloropheuol and then condensing it with monochloroacetic acid in the presence of aqueous sodium hydroxide. About 50 lb. MCP (2 Methy 1-4-Chlorophenoxy acetic acid), was prepared by the chlorination of cresoxyacetic acid in hypochlorite solution. About 90 lb. of TCA were prepared by the oxidation of Chloral hydrate by nitric acid at 80°C. and the isolation of PCA from the reaction mixture by fractional distillation. Part of it was converted to its sodium salt by treating it with aqueous sodium carbonate. The interaction of ethyl chloroformate with analine in the presence of aqueous sodium carbonate gave almost quantitative yield of EPC. The product was purified by crystallisation from 95 per cent. alcohol. Benoxyl chloride reacted with sodium azide and the intermediate azide was decomposed by isopropyl alcohol to give IPC. The method

gives fairly good yields and has been found to be quite convenient and economical. Besides, the method can be extended for the synthesis of various substituted IPCs.

THE EFFECT OF WEEDING—It was concluded at Nagpur that one thorough hand weeding and one application of a stronger than 1 lb. dose of 2, 4-D and equivalent per acre at the early stage of the growth of the wheat crop is effective in controlling the weeds, and the impetus given to the growth of young wheat plant results in better yield than what it would receive in its later stage of growth. Experiments on wheat at Chhabra, Himachal Pradesh showed that hand weeding gave the maximum net profit of Rs. 11/12/- per acre, while treatment with Sodium salt of 2, 4-D gave a net profit of Rs. 6/15/- per acre only. The other weedicidal treatments resulted in loss.

Hand weeding gave ten times more yield than unweeded control, while weedicide treated plots gave five times more yield only in *kharif jowar* experiments at Nagpur. Among weedicide, Ester of 2, 4-D was more effective than Amine 2, 4-D or DNOC, two applications of these weedicides were not significantly effective in putting down the weed population. No ill-effect of these weedicides was, however, observed on *jowar* crop.

*Maize*—Experiments on maize crop revealed at Chhabra, Himachal Pradesh, that there was a decrease in yield over control when weedicides were applied for the eradication of weeds. Hand weeding proved to be most effective and gave about 40 per cent. increased yield over control.

*Paddy*—It has been found at the Bose Institute that the yield of unweeded paddy plots is the lowest, while that of hand-weeded plot (weeded six times during the season) is the highest. The yield in the chemically weeded plots is in between these two, the best being in case of Na-2, 4-D-ethyl sulphate. Considering the cost of this treatment and the yield, it compares favourably with that of the hand-weeded control.

WEEDICIDAL TRIALS ON SPECIFIC WEEDS—(*a*) Complete killing of *Xanthium strumarium* had been observed at Nabhibhag, Bhopal, with 2, 4-D Sodium salt, Amino salt, and Ester 2, 4, 5-T, DNOC and MCPA treated at their seedling or pre-flowering stages. This weed could be effectively controlled by 2, 4-D sodium salt (1 lb./100 gallons per acre), however, at a cost of Rs. 2/13/8 per acre, which was the lowest in comparison with other weedicides. This weed was susceptible to 2, 4-D and DNOC at 0·1 per cent. concentration at all its stages at Nagpur; 2, 4-D and DNOC mixture was, however, more effective than DNOC alone. Similarly, compared to DNOC, the effect of 2, 4-D and DNOC mixture was slower but definite and uniform.

(*b*) *Cassia tora*—*Cassia tora* was more susceptible to 0·1 per cent. concentrations of 2, 4-D and MCPA, compared to Methoxone 2, 4, 5-T and mixture of 2, 4-D and DNOC at Nagpur.

(*c*) 2, 4-D and DNOC, and combination product of these two weedicides, when applied once (at a concentration ranging from 0·1 to 0·25 per cent. in pot experiments) had no effect on kans (*Laccharum spontaneum*) at Nagpur. Promising results were, however, obtained with DNOC and MCPA to 1 per cent. concentration. With the same concentration 2, 4, 5-T and Methoxone were half as affective as the former two weedicides whereas 2, 4-D was totally ineffective.

(*d*) In the pot experiments at Nagpur with one application both 2, 4-D and DNOC (at 0·1 to 0·15 per cent. concentration) had no effect on *Cyperus rotunds*. But MCPA, Methoxone, 2, 4, 5-T and 2, 4-D (all at 1 per cent. concentration) gave very promising results with one done two weeks after their applications. The most effective treatment in Madras was to spray with a mixture of the sodium salts of 2, 4-D, MCPA (at 10 pounds per acre), using a spray volume of 100 gallons per acre. The mortality was 96 per cent. and re-growths were prevented for nearly three months after spraying. The viability of the underground rhizomes or 'nuts' is also impaired to some extent by this treatment. The cost worked out to Rs. 68/8/- per acre. Other alternative treatments which have satisfactory control were spray with the amine salt of 2, 4-D at 20 lb. per acre (cost of Rs. 63/-/-, mortality 78 per cent. in 4 weeks' time) and (2) a mixture of 2, 4-D Butyl Ester and MCPA at 5 lb. each per acre in combination with diesel oil at 5 gallons per acre. The cost of this treatment worked to Rs. 88/8/- per acre.

(*e*) The most effective treatment in Madras against *Hariali* (Cynodon dactylon) was found to be a mixture of 2, 4-D (sodium salt) at 10 lb. per acre plus diesel oil. This controlled re-growths for nearly seven months after spraying. The cost worked out to Rs. 112/8/- per acre.

(*f*) *Psoralea corylifolia* was more resistant to 2, 4-D and DNOC than *X. strumarium* at Nagpur. The effect of DNOC, however, was better in the early stages of plant growth than in the advanced stages, whereas 2, 4-D and DNOC mixture proved uniformly more effective than DNOC at all stages of growth.

(*g*) Unhali (*Tephrosia purpuria*) was susceptible to 2, 4-D, MCPA, methoxone and the mixture of 2, 4-D and DNOC (all at 0·1 per cent. concentration) at Nagpur. Wastula (*Ocimum sp.*) was affected more by 0·1 per cent. concentration of MCPA and 2, 4-D than Methoxone, DNOC or 2, 4, 5-T.

(*h*) Spurry (*Spurry rvenisis*) is a troublesome weed of the Niligiri Hills in Madras. It can be kept in check by using Extra 'A' (a dinitro or the cresol formulation) at 8 lb. per acre at a cost of Rs. 21/12/- per acre. Another weedicide that was very effective, though somewhat more expensive, was Triherbide NIX (Sodium *Isopropyl xanthata*) at 10 lb. in 100 gallons per acre. The cost is Rs. 33/12/.

(*i*) Puliarai (*Oxalis intifolea*) is another persistent weed on the hills of Madras and amongst the weedicides tried, Extra 'A' at 3 lb., Triherbide NIX at 20 lb. and Butyl Ester of 2, 4-D at 5 lb. per acre were the most effective. The cost of these were Rs. 21/12/-, 33/12/- and 48/8/- per acre respectively. However, regeneration occurs after six weeks, to control which repeated sprayings may be found necessary. No suitable weedicides could be found to control economically *Oxalis acetocella*, a troublesome weed in Himachal Pradesh.

(*j*) Ester formulations of 2, 4, 5-T were very effective against *Lantana* shrubby weed in Madras. But on account of its high cost, it is preferable to use a mixture of 2, 4, 5-T and 2, 4-D esters available under the name of Brush Killer. Very satisfactory control is obtainable with 10 lb. per acre dosage of Brush Killer, the cost of which comes to about Rs. 125 per acre. The weedicidal effect is greater if the bushes are first pruned off before spraying the weedicides.

(*k*) Sodium salt of 2, 4-D at 4 lb. per acre was very effective in destroying Saranai (*Triantheme portulacastrum*) weed in Madras. Isopropyl ester was even more effective. But in edition to its higher cost there is also a risk of spray drift injury to adjacent crops by use of this volatile chemical. The cost of the sodium salt, 2, 4-D treatment worked out to Rs. 19 per acre.

(*l*) Any of the formulations of 2, 4-D or MCPA at a dose of 2 lb. per acre of the acid equivalent is effective in controlling *Acanthospermum hispidiumy* weed in Madras. The total cost varies from Rs. 8 to Rs. 16 per acre, depending upon the chemical used.

(*m*) Sodium 2, 4-D at 5 lb. per acre, or a mixture of 2, 4-D and MCPA gave a good kill of *Aristolochia bracteate* weed in about a fortnight in Madras. The cost works out to nearly Rs. 23 per acre. Repeated sprays may be found necessary, sometimes to destroy the fresh growths that arise from the underground roots.

It has been confirmed at the Bose Institute that the broad leaved plants are generally more susceptible to the 2, 4-D group of chemicals than the narrow leaved. Besides, within the same group of plants, the susceptibility varies from species to species.

Preliminary investigations on the fundamental effects of these chemicals on the weeds showed that anatomically these chemicals destroy vital tissues like phloem and damage others like xylem. Physiologically, transpiration and photosynthesis are adversely affected by the herbicidal treatments, whereas the rate of respiration is enhanced, after an initial fall; the plant finally succumbs. The stage of the plant growth also, has definite relation to the most effective stage for the application of herbicides, in relation both to the weeds and the crops. With regard to paddy, early stage (about 6 week old) is most suitable. With regard to weeds either in fallow lands or in fields, where there is a big gap between the time of flowering of the weed and the crop pre-flowering stage of the weed is more effective.

The effect of herbicides can be modified by the atmospheric conditions. Study of the relations between atmospheric conditions and the optimum results from the application of herbicides has revealed that hot and dry conditions are more favourable. The duration of retention of the toxicity of herbicides in soil varies between the chemicals. Experiments to test the retention of toxicity of the different chemicals in the soil have been conducted by means of the "Melilotus germination test". It has been found that the cost of chemical weed control as a rule is lower than that of manual weeding. However, in view of the relative yield performances, it has been concluded that the use of Na-2, 4-dichlorophenoxy ethyl sulphate is favourable.

In general, weedicides showed greater effect in Madras when sprayed on the young plants. By correct timing, it would be possible to bring down the cost of weedicide treatments. In the case of certain volatile formulations, great care is necessary to avoid spray drift damage to adjacent sensitive crops like cotton and castor. Under ordinary field conditions, the residual toxicity of weedicide chemicals passes of in the course of 4 to 5 weeks and crops grown on field previously sprayed with weedicides may seldom show any reduction of growth or yield. Often the yields are higher than if no weedicides had been used.

## FERTILIZER DEMONSTRATION SCHEME

The Indo-American programme of fertilizer demonstrations was started in 1954. The Technical Co-operation Mission supplied fertilisers in the first year, two-thirds in the second year, and one-third in the third year. This cooperative programme was concluded in March 1957.

The primary purpose of the fertilizer demonstrations was to acquaint the farmer with the value of chemical fertilizers as a plantfood and introduce him to the new fertilizers which will be produced in India.

During the three years, about 600,000 demonstrations were conducted all over India. To obtain uniformity in demonstration lay-out, the Government of India prepared a fertilizer demonstration working plan. Each state could vary this plan to meet the local needs, but most of the States followed the suggested uniform plan. This made it possible to summarise the yield results statewise and on all-India basis.

The following table gives all-India two-year (1954-55 and 1955-56) average response to chemical fertilizers when applied to paddy and wheat :

| | Fertilizer treatment (lb. per acre) | 2 year average yield lb. | Increase over control lb. | Return on fertilizer investment % |
|---|---|---|---|---|
| *Paddy* | Control | 2,316 | .. | .. |
| | 30 N as amm. sulphate | 2,666 | 350 | 90 |
| | 30 N+30 $P_2O_5$ | 3,080 | 764 | 170 |
| *Wheat* (irrigated) | Control | 1,159 | .. | .. |
| | 30 N as amm. sulphate | 1,382 | 223 | 83 |
| | 30 N + 30 $P_2O_5$ | 1,656 | 497 | 173 |

*Selling Prices*:

| | |
|---|---|
| Paddy | Rs. 10 per md. |
| Wheat | Rs. 15 " |
| 30 lb. N as amm. sulphate | Rs. 23 |
| 30 lb. N plus 30 lb. $P_2O_5$ | Rs. 34·4 (60% super charged first year). |

The fertilizer demonstrations are gradually making the cultivators fertilizer-conscious.

## COORDINATED AGRONOMIC EXPERIMENT SCHEMES

(1) **Co-ordinated scheme of Fertilizer Trials**—The aim of simple fertilizer trials is to estimate the average response to fertilizers in a given tract, and to study the response variations from locality to locality, so that suitable manurial schedules may be drawn up for the benefit of cultivators. More specifically, the objectives are :

(*i*) Response to nitrogen, phosphate and potash and their interaction;

(*ii*) Relative value of nitrogenous fertilizers, namely, ammonium sulphate, urea, ammonium sulphate-nitrate, calcium ammonium nitrate and other nitrogenous fertilizers that may be manufactured in the country ;

(*iii*) Phosphate response to legumes and its residual effect on the succeeding crop ;

(*iv*) Relative value of dicalcium phosphate and superphosphate ; and

(*v*) Cor-relation of fertility status of soil with crop response.

With these objectives in view, three types of simple trials have been planned to be conducted in cultivators' fields in the irrigated or assured rainfall areas (35 inches and above) of the country. There are about 318 districts in the country of which about 256 have assured water supply either from irrigation or rainfall. Under the Scheme, 200 districts have been selected for experimentation. Financial sanction for 150 districts of the major States of the country, was issued by the I.C.A.R. on July 1, 1957.

For conducting the simple trials, the selected district is divided into four homogenous tracts and in each tract one field assistant is appointed. During the year he conducts 31 experiments, the crop-wise distribution of which is eight on *Kharif* cereal, eight on *Rabi* cereal, eight on cash crop, four on major oilseed crop and 3 on major legume of the tract. For every two districts, one supervisor is appointed to supervise the work of the field assistants.

During 1957-58 the scheme was sanctioned for 14 States. The information regarding the staff appointed till May 1958, along with the number of simple trials conducted in various States is given below:

| State | No. of districts for which sanction has been issued. | Staff sanctioned | | Staff appointed | | No. of expts. conducted up to May, 1958 |
|---|---|---|---|---|---|---|
| | | Supervisors. | Field Assistants. | Supervisors. | Field Assistants. | |
| 1. Delhi | 1 | .. | 4 | .. | 4 | 60 |
| 2. Himachal Pradesh | 2 | 1 | 8 | 1 | 8 | 64 |
| 3. Kerala | 3 | 1 | 12 | 1 | 7 | 47 |
| 4. Madhya Pradesh | 2 | 1 | 8 | 1 | 2 | 121 |
| 5. Orissa | 9 | 4 | 36 | 1 | 36 | 42 |
| 6. Rajasthan | 2 | 1 | 8 | 1 | 8 | 203 |
| 7. Punjab | 11 | 5 | 44 | 5 | 28 | 308 |
| 8. Mysore | 10 | 5 | 40 | 4 | 12 | Nil |
| 9. Bihar | 11 | 5 | 44 | .. | 44 | .. |
| 10. Andhra Pradesh | 13 | 6 | 52 | .. | .. | .. |
| 11. Bombay | 28 | 14 | 112 | .. | .. | .. |
| 12. Madras | 8 | 4 | 32 | .. | .. | .. |
| 13. Uttar Pradesh | 40 | 10 | 160 | .. | .. | .. |
| 14. West Bengal | 10 | 5 | 40 | .. | .. | .. |

Out of the 14 States mentioned above, seven States, namely, Delhi, Himachal Pradesh, Kerala, Madhya Pradesh, Orissa, Rajasthan and the Punjab appointed part of the staff during 1957 and conducted 843 experiments during *Kharif* and *Rabi*, 1957-58. The results of these experiments are being compiled for statistical analysis by the Statisticians appointed recently under the Scheme. Three States namely, Orissa, Bihar and Mysore have appointed the field staff very recently. All the preliminary arrangements have been completed to post them in different thanas, where they would conduct the experiments during *kharif*, 1958. In the remaining five States, namely, Andhra Pradesh,

Bombay, Madras, Uttar Pradesh and West Bengal, the Scheme has been accepted by the State Governments and included in the State plans; the Agricultural Chemists are making necessary arrangements to appoint the field staff.

Supervisors and field assistants appointed in various States were given field training for more than eight days by the Agronomist and Assistant Soil Chemist of the I.A.R.I., and the Statistician of the I.C.A.R. So far the training of the field staff has been completed for Himachal Pradesh, Rajasthan, Bihar, Orissa, Mysore and Kerala States.

(2) **Model Agronomic Experiment Scheme**—Under this scheme, complex manurial, cultural, rotational and irrigational experiments are being conducted at selected centres in the various agro-climatic regions of the country. The objectives of these experiments are :

(*i*) To investigate the optium depth and delta of irrigation in relation to doses of nitrogen and phosphate for second crop of paddy, wheat, cotton and maize;

(*ii*) To work out the manurial requirement of various crop rotations;

(*iii*) To study the response of phosphate fertilization of legumes and its residual effect on cereal or cash crops compared to direct nitrogenous manuring of these crops;

(*iv*) To find out the suitable method and optimum time of application of fertilizer for major field crops;

(*v*) To investigate the inter-relationship of fertilizers to cultural practices, such as dates of sowing or planting, seed-rates, spacing etc.

With these objectives in view eight complex factorial experiments were planned for conducting at 34 Centres, representing the various agro-climatic regions of the country. At each Centre, an area of 15 acres has been leased from cultivators and experiments were conducted on five acres at a time in rotation in each season. During 1957-58, financial sanction was issued for 33 centres, the site for the remaining centre to be located at Kakarpara Irrigation Project (Bombay State) has not been finalized. Out of 33 centres, two centres located in Bihar were selected and approved by the sub-committee on Fertilizer Trials in April, 1958. As such, no experiments were taken up at these two centres.

The number of experiments conducted at the various centres during the year 1957-58 (*Kharif* and *Rabi* seasons) are given in Table below :

TABLE

| State | Centre | Total No. of expts. conducted | Season-wise and Crop-wise distribution of experiments | | | |
|---|---|---|---|---|---|---|
| | | | Kharif | | Rabi | |
| | | | Crop | Type of Expt. | Crop | Type of Expt. |
| Andhra Pradesh | Maruteru | 6 | Paddy | 2,7 | Paddy | 2,4,5,7 |
| | Chinnegonehal | 4 | Paddy | 2, 4, 5, 7 | | |
| | Chalvai | 4 | Paddy | 6 (TCM), 7 | Wheat | 4 |
| | | | Kharif Legumes | 4 | | |
| Bombay | Karjat | 6 | Paddy | 2, 4, 5, 6 (TCM) 6,7. | | |

TABLE—*contd.*

| State | Centre | Total No. of Expts. conducted | Season-wise and crop-wise distribution of experiments | | | |
|---|---|---|---|---|---|---|
| | | | Kharif | | Rabi | |
| | | | Crop | Type of Expt. | Crop | Type of Expt. |
| Bombay | Umrala | 6 | Cotton<br>Kharif legume<br>Jowar | 2,5<br>4 | Wheat | 4, 8 |
| | Lakhmapur | 7 | Kharif Legumes | 4 | Wheat | 1,4,5, 6<br>6 (TCM) |
| | Akola | 2 | Cotton<br>Jowar groundnut<br>Cotton | 2<br><br>8 | | |
| Kerala | Karumanam | 3 | Paddy | 2,5,8 | | |
| Madras | Aduthurai | 7 | Paddy | 2,4,5, 6<br>6 (TCM) | Paddy (second crop)<br>Cotton | 2, 6 (TCM) |
| | Bhavanisagar | 5 | Cotton<br>Jowar | 2,5<br>6, 8 | | |
| Madhya Pradesh | Bhagwai | 7 | Paddy<br>Kharif legumes | 2, 3, 4, 6 (TCM), 7<br>4 | Wheat | 3, 4, 8 |
| | Ujjain | 9 | Cotton<br>Jowar<br>Cotton<br>Jowar<br>G. nut | 5, 8,<br>5, 6, 8<br><br>6 (TCM) | Wheat | 5, 6, 8 |
| | Raipur | 5 | Paddy | 2,4,5,6,7 | | |
| | Satna | 5 | Paddy | 5,6,7 | Wheat | 1,8 |
| | Obedullahgunj | 6 | | | Wheat | 1,3,5,6,<br>6, (TCM) 8 |
| | Powerkheda | 7 | | | Wheat | 1,2,3,4,5,6,8, |
| Mysore | Gangavati | 5 | Jowar<br>Kharif legumes | 2,8<br>4 | Wheat | 2,4 |
| | Shimoga | 4 | Paddy | 2,5,6, 6 (TCM) | | |
| | Ponnampet | .. | .. | .. | .. | .. |
| Orissa . | Kendrapara | 4 | Paddy | 2,4,6, (TCM) 7 | | |
| | Barapalli | 9 | Paddy | 2,3,4,6 | Wheat<br>Cotton<br>Potato | 1,3<br>3,5,8 |
| Rajasthan . | Shriganganagar | 7 | Cotton<br>Kharif legumes | 2,3<br>4 | Wheat | 1,2,4,8 |
| Punjab . | Nasirpur | 9 | Paddy<br>Maize<br>Cotton<br>Kharif legumes | 5<br>8<br>2<br>4 | Wheat | 1,4,5,6,8 |
| | Sirsa | 4 | Cotton<br>Kharif legumes | 2,3<br>4 | Wheat | 4 |

TABLE—*concld.*

| State | Centre | Total No. of expts. conducted | Season-wise and crop-wise distribution of experiments | | | |
|---|---|---|---|---|---|---|
| | | | Kharif | | Rabi | |
| | | | Crop | Type of Expt. | Crop | Type of Expt. |
| Uttar Pradesh | Kanpur (pura farm) | 7 | Maize<br>Kharif legumes | 6 (TCM)<br>4 | Wheat | 4,5,6, 6(TCM) 8 |
| | Varanasi | 5 | Maize<br>Kharif legumes | 6 (TCM)<br>4 | Wheat | 4,6,6 (TMC),8 |
| | Bichpuri | 5 | Til<br>Maize<br>Kharif legumes | 8<br>3<br>4 | Wheat | 3,4, |
| West Bengal | Burdwan | 6 | Paddy | 2,4,5,6, 6 (TCM), 7 | | |
| | Digha | 5 | Paddy | 2,4,5,6, 6 (TCM) | | |
| Assam | Tinsukia | 4 | Paddy | 3,4,5,7 | | |
| Jammu & Kashmir* | Kudwani | 5 | Paddy | 2,4,5,7 | | |

*Layout plans were sent, but whether the experiments were conducted or not is not known.

During the year, 169 experiments were conducted at 31 centres.

The data of most of these experiments have been received by the Statistical Wing of the I.C.A.R. for analysis.

## SOIL SCIENCE

### SOIL IMPROVEMENT

(a) **Land Reclamation**—In the scheme for the study of composition of plants growing in *Usar* lands under reclamation (started in 1956), in the Botany Department of Lucknow University, experiments were conducted both under pot culture and in field. Natural soils typifying the various stages of salinity and alkali were used in pot culture. Field samples representing three stages in reclamation were obtained. Barley variety K-12 was sown in pot soil culture at three levels of alkalinity (*p*H 8·5, 9·0 and 10·0) each at two levels of salinity. Sites having the same variety of barley at three alkalinity levels (*p*H 8·6, 9·2 and 9·8) representing three stages in the reclamation of typical *Usar* soil, were selected. Additional nitrogen was added to one series of pot culture and its effect on the availability of other nutrients studied. Plants raised in pot soil culture and in field were analysed at three stages of growth for micro and micro-nutrient elements, ascorbic acid, chlorophyll, carbohydrate and nitrogen fractions. Plants showing good and bad growth were collected and analysed for catalase activity.

Growth was markedly depressed at high alkalinity (i.e., *p*H 10 in pot soil culture and *p*H 9·8 in the fields). Growth became better and yields increased with a lowering of the *p*H to 9·0 in the pots and 9·2 in the fields. On a further lowering of *p*H, yields were further increased in pot culture. The highest yields were, however, obtained at *p*H 9·2 in the fields. Yields of

the field plants were five to six times more than that of plants raised in unreclaimed *Usar* soils in pot culture ; but were about ten times less than that of plants grown in sand culture in which root space was limited. Addition of nitrogen in pot culture resulted in increased yield and better growth at the three *p*H levels. The effect was, however, least marked at *p*H 10·0.

Potassium and phosphorus were markedly depressed at high *p*H (9·8 and 10·0) both in fields and in pots. Lowering of *p*H both in pot culture and in the fields under reclamation, brought about a very favourable response on their availability. Better growth of plant corresponded to an increase in potassium and phosphorus content of plants both in fields and pot. Nitrogen content (especially protein nitrogen) was high both in the field and in pot culture. A marked increase in growth was found, however, at all *p*H levels in pot culture studies with addition of nitrogen, the increase being least marked at *p*H 10. Availability of magnesium and calcium was, in gerneral very low, but was increased by the addition of Nitrogen to the soil in pot culture. In the plants in unreclaimed *Usar* soils in pot culture, iron, zinc and molybdenum were unusually high. Addition of nitrogen to the soils of different *p*H and salinity in pot culture resulted in depression of iron, zinc, and molybdenum. But manganese and copper were not affected with field conditions, iron and zinc were comparatively low.

A comparative study of plants (at 65 days) in the same blocks showed that plants showing bad growth, compared to plant showing good growth, had a high concentration of iron, manganese, copper and zinc. Catalase activity and chlorophyll did not show appreciable difference in the good and bad samples showing thereby that iron was not in short supply. Molybdenum, on the whole, appears to be rather high both in pot culture and in the fields. No starch was found at 8·5 to 10·0 in the pot culture on (unreclaimed) *Usar*. Grains at high *p*H were considerably low in starch in the fields. Reducing sugars were depressed at high *p*H. Ascorbic acid showed an appreciable decrease with fall in *p*H and increase in growth. But a higher ascorbic acid content was found in plants showing bad growth.

**(b) Soil conditioners**—The scheme on "Synthetic Polyelectrolytes as Soil Conditioners" was in operation since 1957 at the Indian Association for the Cultivation of Science, Calcutta, under Prof. Palit with the object of preparing Krilium type Polyelectrolytes and studying their effect in aggregation in various types of Indian soils. Krilium type of the materials were synthesised from the starting material acrylonitrile. The work involved the following five steps : (*a*) thorough purification of the monomer, acrylonitrile, (*b*) synthesis of catalysts, (*c*) polymerization, (*d*) determination of molecular weight, and (*e*) hydrolysis.

SOIL ENRICHMENT

**(a) Humification**—The object of the scheme for research on "humification of organic matter in relation to the physico-chemical properties of soils" at the Agra College, in operation since 1953, was to study the physico-chemical properties of soils in relation to humification of organic matter and to correlate the effect of artificial humification on the fertility status of soils in the Agra district. The experimental results indicate that the mineralised nitrogen

content in the 'dumat' soil of Agra district can be increased by the humification of local weeds and plants, irrespective of their being leguminous or non-leguminous. In most cases of humification, the *p*H of the soil drifted slightly towards alkalinity at the end of 16 weeks, while in case of *Chhotta dahatura* (*Xanthium stumarium*) and *Chakwad* (*Cassia obtusifolia*) the *p*H of the humified soil samples drifted slightly towards acidity. The moisture content of the 'dumat soil' increased considerably as a result of humification. Sticky-point and porosity values were definitely higher in humified soil samples than in the original untreated soil. These definitely indicate that the essential physical properties are much improved by the humification of the leguminous and non-leguminous weeds and plants. Exchangeable calcium also increased in humified soil samples in comparison to the original untreated soils. But no sharp distinction can be made between non-legumes and legumes as regards free exchange property in soil by their humification.

(b) **Earthworm Culture**—In the Scheme for the Survey of the Micro-flora of soils in relation to their structure and the role of earth-worms in the Micro-flora of soils which has worked for three years (i.e., 1954 to 1957) at Fermentation Technology Laboratory, Indian Institute of Science, Bangalore, counts of bacteria, actinomycetes and moulds, studies on the physiologically active groups of micro-organisms in soil, and dry aggregate and mechanical analysis of soil data such as *p*H, colour, moisture, etc. have been made. A few genera of bacteria distinctly dominate over the others in their biochemical ability. The most versatile and commonly encountered micro-organism in soils, however, was *Pseudomonas*. Besides decomposing organic matter, some soil pseudomonads produce polysaccharides which have an important role in the cementing of soil particles. In the case of pectin decomposition, the type of organism involved depends on the type of soil. The coarser (sandy and sandyloam) soils harboured more of sporeforming pectinolytic bacilli. Quantitative utilisation of pure pectin by some pure cultures of *Pseudomonas* was observed, though so far relatively few claims regarding pectin fermentation have been substantiated with chemical evidence. Further pseudomonads have not been incriminated in the process until very recently. Besides the pseudomonads, moulds belonging to the *Aspergillus* and *Penicillium* genera seem to be equally important entities responsible for the breakdown of inositol and oleate in soils.

Experiments were conducted in the laboratory as well as in the field on the role of earth-worms in the alteration of micro-flora of soils. Usually earth-worms were found to influence favourably the numbers of *Azotobacter* cells in soil. But there was no consistent increase or decrease in the total bacterial, actinomycal and fungal populations of the soil due to the presence of earth-worms. The earth-worms did not seem to appreciably influence either the number or the types of some of the physiological groups of soil micro-organisms, although a slight increase in the number of cellulose, pectin oxalate and inositol utilising micro-organisms was recorded. No conclusions could be drawn regarding the influence of earth-worms on the coliform flora of soils. Inasmuch as the nitrogen-fixing bacteria, *Azotobacter*, and to a lesser extent, the cellulolytic, pectinolytic, and oxalate and inositol-decomposing micro-organisms undergo an increase in the soil due to the activities of earth-worms, it may be assumed that there exist certain other specific types of micro-organisms which may be influenced by earth-worms. Further experimentation on the more specific

physiological types of micro-organisms may reveal more facts on the role of earth-worms in the soil insofar as their influence on soil microflora is concerned.

(c) **Inoculation**—In the Scheme for research on Azotobacter inoculation of crops (in operation since 1951) at the State Agricultural Research Institute at Tollygunge in West Bengal, to find out the effect of inoculation of the seeds with Azotobacter on the growth and yield of *aus* paddy and jute, a new species of nitrogen-fixing organism was isolated from the soils of Adisapagiam. Study of its morphological and cultural characters, showed that the cells are rod shaped and are sometimes surrounded by a capsule. Dark granular bodies are present along the cells. The size of the cells varied from 3·3 to 5·4 microns. The Organism grew well on nitrogen-free medium containing glucose or mannite. But no growth was observed in medium containing dextrin or sucrose. The organism fixed 12 to 21 mg. of nitrogen per gm. of sugar consumed. Maximum amount of fixation was, however, observed in medium containing $KH_2 PO_4$. It was found that molybdenum stimulated nitrogen-fixation but the amount of nitrogen fixed was independent of the concentration of molybdenum. Maximum amount of nitrogen was fixed at pH 6 and 7 in medium containing mannitol and glucose respectively. A fall of *p*H was observed in the medium after inoculation.

In the studies on the effect of legume seed inoculation and strain competition (in operation since 1956) at the Presidency College, Calcutta, in addition to the old strains, about 16 different strains of the root nodule bacteria of pulses viz., *Cicer*, *Lens*, and *Phaseolus* were collected from different parts of West Bengal. Morphology and size of nodules and cultural characteristics were noted in each case. These strains were isolated, sub-cultured and purified by dilution and plate method. Experimental plots were inoculated with one strain at a time. Nodules produced on these plants were studied and were also used for isolating further strains. About 36 plant passage strains were obtained in the laboratory. Nodules are significantly absent on *Cicer* plants in garden plots unless the seeds are inoculated with good strain (Berhampur strain of *Cicer*) prior to sowing.

**Standardisation of Methods**—The scheme for "Standardisation of methods of soil analysis" under Dr. A.N. Puri, Director, Field Research Station, Bombay in operation since 1954, was aimed at examining the existing methods of soil analysis and selection, with suitable modifications, of the most appropriate methods for Indian soils under Indian conditions. During the year the following methods were formulated as brought out in the following bulletins.

*Bulletine No. 5*—Organic Carbon : Methods for determining Organic carbon and humus.

(*i*) Walkley and Black's method.

(*ii*) Puri's alkaline permanganate method.

*Bulletin No. 6*—Determination of ultra clay in soils.

(*i*) Puri's Micro pipette technique.

(*ii*) From vapour pressure curves.

*Bulletin No. 7*—Determination of hygroscopic moisture and vapour pressure curves and soils.

*Bulletin No. 8*—Titration curves and dissociation contents of soils.

## ENTOMOLOGY

### INSECT PHYSIOLOGY

Under the scheme for nutritional and biological studies on insects of agricultural importance, investigations are under progress at the Indian Agricultural Research Institute, New Delhi since 1956, to determine the nutritional requirement of insects with reference to their relation between food and feeding habits. *Rhizopertha dominica* was reared on various plant products and the developmental and survival response of its stages was observed. *L. oryzae* was fed on several cereals, millets, pulses and spices at both larval and adult stages and the nutritional value of these cereals was recorded. A new technique of rearing *Sitophilus oryzae* on artificial grains has also been devised.

The scheme for investigating physiological relationships between insect pests and their host plants, has been in operation since 1956 at the Delhi University. A study was made of the food and feeding characteristics of *Oxycarenus Ioetus*, (a pest of cotton and other malvaceous plants). Investigations on its preference to a variety of malvaceous plants showed that among hollyhock, cotton and ladies' finger plants, *Oxycarenus Ioetus*, showed a distinct preference to hollyhock over the other two. It was also found that in a majority of cases food passed through the entire alimentary canal of the insect rapidly, the first lot being excreted out between 45 minutes. and 1 hour 20 minutes.

**Insecticidal studies**—A co-ordinated scheme has been in progress at Poona since 1956 to investigate the efficacy of different formulations of DDT, BHC and allied insecticides against important pests under Indian conditions.

(*a*) In the pink boll-worm trials on cotton in one experiment, four spray applications of 8 ozs. of endrin per acre and 0·02 per cent. gusathion gave significantly lower incidence of the pest than the untreated cotton and also gave significantly higher yields. In another similar experiment three applications of endrin (8 oz. per acre) and gusathion (0·02%) did not give significant decrease in infestation in bolls, but endrin showed significantly less incidence in locules and higher yield. In a third spraying experiment, where 4, 6, and 8 sprays of endrin (8 ozs. per acre) were compared with 6 applications of 0·02% thiometon gusathion and diazinon each, it was observed that 4 applications of endrin and 6 of thiometon did not give significant decrease in incidence in bolls as well as increase in yield. Though diazinon gave significant decrease in incidence, it gave lower yield than the untreated. Trials conducted with 1% endrin dust and DDT, BHC, plus sulphur mixture indicated that 4 applications of either of them gave significant decrease in the incidence of pink boll-worm accompanied with higher yields. In another experiment, 7 applications of these dusts gave similar results.

(*b*) In Aphid trials, in one experiment, endrin 2 ozs., 4 ozs., parathion 0·02%, 0·04% and BHC 0·2% were all found to be superior to nicotine sulphate. This was also confirmed by a second experiment on the same lines. In a third experiment, however, nicotine sulphate was not found inferior to 0·02% parathion and endrin (2 oz. per acre).

**Toxicity Studies**—A scheme has been in progress since 1956, at the I.A.R.I. New Delhi, for exploration of toxicity hazards in the use of modern insecticides against cattle and human beings, with a view to finding out the limits to which these insecticides could be safely used on agricultural crops and stored grains without danger of poisoning to men and cattle.

Result of investigation on stored foodgrains indicated the stability of DDT, during the two months' storage of treated wheat grains in jars under room conditions (where the temperature and humidity ranged from 62 °F to 100°F and 5 to 6 per cent. R. H. respectively). There was no decrease in the DDT residues. Bioassay studies taking *T. granaria* adults as test insects, also confirmed this.

In a field experiment on *Kakri* (*Cucumis melo*), four dustings of 5% DDT dust at the rate of 6-12 lb./acre were given up to the flowering stage at weekly intervals. Chemical analysis showed that there was no translocation of the insecticide in the fruit. In another experiment, the fifth dusting was given when small fruits had appeared. There were practically no DDT residues in the samples collected a week after the final dusting. In another field experiment, *bhindi* crop (*Abelmoschus esculentus*) was dusted thrice with 5% DDT (at the rate of 6 to 12 lb./acre) at fortnightly intervals. *Bhindi* fruits collected a week after dusting gave DDT contents from 0·3 p.p.m. to 0·85 p.p.m., indicating that the field conditions have caused considerable loss of insecticidal residues in one week and the quantities present are much less than the tolerance limit prescribed.

### CARDAMOM PESTS

Investigations are under progress into foorkey disease of cardamom in West Bengal, at Kalimpong. It was observed that the population of insects is the maximum from March to May and spraying the plantations during the period appeared to prevent the future incidence of the disease considerably. Further folidol E 605 spray was found to be more effective in killing the cardamom pests than nicotine sulphate or tabacco decoction. Manurial experiments in different centres indicated that application of manure could bring about increased yield and also that the disease was not due to poor soil conditions. It appeared that either super phosphate alone or in combination with ammonium sulphate gave good effect.

### CASHEWNUT PESTS

Study of the different pests on cashew at Coimbatore showed, that the most damaging insects are : the cashew root and stem borer (*Plocaederus ferrugineus L.*) the leaf thrips—(*Selenothrips*,) etc. affected the young plants seriously ; the leaf miner (*Acrocercops syngramma M*) severely damaging fresh leaves; the tea mosquito, (*Hexlopitis antonii S*) injuring a number of tender shoots; and the caterpillar (*Chelaria haligramma M*) affecting the tender shoots and inflorescence.

The pests of lesser importance were: the leaf webber (*Orthage sp.*), the leaf eating hairy caterpillar (*Metanastria hyrtaca C*), the flower thrips (*Rhynchothrips raoensis G*) and yellow thrips (unidentified), the aphid (*Taxeptera odinae*) viz., the mealy bugs (*Ferisiana virgata C*), the apple and nut borer (*Thylacoptila panrosema M*) and a Chrysomelid beetle. Although these are generally minor pests, they could become serious in isolated areas occasionally.

Others like the Geometrid caterpillar (Oenospila), a small green leaf rolling caterpillar, Tortricid caterpillar, some scales, Myllocaras and other weevils, etc.; were always of minor status only.

(a) **Shoot drying**—The bug (*Holopeitis antomii S.*) was noted to be causing an appreciable degree of shoot drying in nurseries and on isolated trees. Shallow soil conditions with rocky sub-strate, fungi causing die-back, etc., were the other causes.

(b) **Inflorescence drying**—Inflorescence drying was noted in a light degree in some gardens. Aphids, thrips, mealy bugs and the tea mosquito (*Helopeltis*) caused drying up of inflorescence and shedding of flowers to some extent. The caterpillar *Chelaria haligramma M.* was noted to cause severe damage in the Sendurai area in Tiruchirappalli district. It was found to bore into inflorescence in the early state. This is distinct from blossom withering observed in other gardens.

(c) **Insecticidal trials**—An observational trial against the cashew borer *Plocaderus flurrugineus L.* indicated the usefulness of applying BHC 0·1 per cent. to the basal portion of the trunk and root region for controlling the pest after the mechanical removal of live stages.

TERMITES

Termite research schemes are in progress at (1) I.A.R.I., New Delhi; (2) Zoological Survey of India, Calcutta ; (3) Forest Research Institute, Dehradun and (4) Agricultural College and Institute, Anand.

The scheme at the I.A.R.I., New Delhi in operation since 1952, is primarily to evolve suitable insecticidal control measures against termites attacking agricultural crops, such as wheat, sugarcane, and cotton. Termites cause considerable damage to sugarcane, and wheat in Madhya Pradesh, more so in unirrigated areas, and in the case of the latter, *Cyclotermes* spp. appeared to be commonly associated throughout Madhya Pradesh. Samples collected from wooden poles in 'Pan' gardens in Nagda village, were identified as *Odontotermes* sp. In an experiment to study the effect of different seed rates on the incidence of termites, tests with wheat (of 50, 60, 70 and 80 lb. per acre) showed that there was no significant difference for percentage damage yield, etc. Aldrin, Chlordane and Dieldrin (0·25%, 0·5 and 1·0%) at 16 gallons per acre gave significant control of termites in cotton.

At the Forest Research Institute Centre, Dehradun, revision of the genus *Nasutitermes* (Family Termitidae: Sub-family Nasutite mitinae) is almost completed. Work was also carried out to revise the genus *Hospitalitermes* and the other genera of the sub-family.

At the Anand Centre, a scheme has been in progress since 1952 to study the distribution and life-history of different species of termites in Gujerat and to advise suitable control measures. Field trials with Aldrin, BHC, Chlordane DDT, Dieldrin, Endrin, Lindane and Toxaphene either as dust in furrows or paste on the cut ends, or dipping the sugarcane sets before sowing showed that 5 per cent. BHC at 50 lb. per acre along the furrow (which is a recommended method) was inferior to most other compounds like Dioldrin, Aldrin, Endrin, used in similar manner. Some of the best treatments in order of decreasing percentage of germination of sugarcane sets were 2·5 per cent. Dioldrin dust,

2 per cent. Aldrin dust, 1 per cent. Endrin dust, 5 per cent. Chloradane dust and 1 per cent. Aldrin. Past experiments showed that seed treatments of wheat with Aldrin, Dioldrin, DDT, BHC or mercurial fungicides did not give better germination or better stand or increased yield. Preliminary experiments to ascertain the effect of castor cake for termite control has shown that though there is slightly less infestation in crops treated with castor cake as compared to farmyard manure and untreated, the difference is not of sufficient magnitude to be relied upon for practical control. Attempts made to control termites by poison baits of 5 per cent. DDT or Paris green or 1 per cent. Endrin did not give satisfactory control of existing infested patches.

RATS

The scheme for the systematic and biological studies of rats of Delhi, is in operation at the Delhi University since June 1956, with the object of collecting knowledge about the common Delhi rats, their burrowing and breeding habits, and to adopt control measures. In all 868 rats belonging to six different genera *i.e.*, (1) *Rattus rattus* (house rat), (2) *Muss dubius* (house mouse), (3) *Nesokia indica* (field rat), (4) *Bandicota indica* (field rat), (5) *Gerbillus indicus* (field rat) and (6) *Meriones hurrianae* (field rat), have been collected from the Delhi city. Out of these, the first two are found in houses and the other four varieties in fields. Study of their burrowing habits reveal that no particular pattern is followed in the making of burrows by the different rats. The longest burrow opened was 84 feet in length. The depth of the burrow varies from 2″ to 14″ while the diameter ranges from 2 to 8 inches. Breeding chambers are also found in the burrows. The method of catching the field rats by means of flooding the burrows with water was not successful in the case of very long burrows.

MYCOLOGY

**Cardamom diseases**—Under the co-ordinated Plant Virus Research Scheme (Eastern Zone), at Kalimpong, West Bengal, survey work was carried out in 73 orchards, nurseries and gardens (including tea gardens), besides the State Agricultural Farm at Kalimpong. Observations in Algarah in Kalimpong Subdivision showed that the disease was characterised by typical mosaic symptoms and was associated with yield reductions in cardamom. Preliminary transmission tests showed that the casual agent was virus. The disease causes severe crinkling of the leaves accompanied by vein clearing, profuse vegetative growth from the main axis, and malformation of flowers.

**Cashewnut diseases**—In the scheme for research on pests and diseases of cashewnut at Coimbatore, Madras, it was noticed that dieback of pink disease (caused by Pollicularia salmonicolat), was a major disease prevalent along the coastal areas. The incidence was high in localities where the trees were grown on poor soil or hard substratum. The drying up of the twigs and bigger branches was higher at Nileshwar (South Kanara) and Pudukudi (Tiruchirappalli) areas than in other places. However, this disease could be controlled by adopting field sanitation and spraying. The grey blight (*caused by Pestalotia dichaeta*) was widespread and caused leaf spots to a considerable extent, specially on older leaves. The shoot drying, a combined effect of insect puncturing and later infection by *Gloeosperius mangiferae* and *Phomopsis anacardii*, however,

seemed to be the major problem in cashew growing areas. Though the affected trees put forth new shoots below the dried ones, they were also in turn attacked and consequently dried up. This malady was higher on the West Coast than in the East Coast districts. Apple rot and nut spotting were found to be occurring along both the coastal tracts, causing damage mainly to the cashew apple but sometimes extending to the green nuts also. The inflorescence drying, caused by *Gloosporium mangiferae* was also widespread but the extent of damage varied from place to place. The other minor diseases, namely the leaf spots (caused by *Labridium* sp., *Ceratophoma* sp., *Mycosphaeralla* sp., *Coniothyrium* sp. and *Beltrania* sp.) were also recorded with varying intensity of infection.

In storage, up to 18 per cent. of the cashew kernels were affected by *Aspergillus niger* and Rhizopus. The infection might be due to storing immature nuts or improperly dried nuts before storage. Black spot disease, (the cause of which is being investigated), was found more in the South African nuts extending up to 4·83 per cent. while it was only up to 0·77 per cent. in the Indian nuts.

**Cashewnut parasite**—Investigations on pest and diseases of cashewnut plantations at Coimbatore Madras, revealed two phanerogamic parasites, viz., *Cuscuta* sp. and *Loranthes* sp., parasitising cashew plants.

PARASITIC WEEDS

**Bundha Weed**—The scheme for the control and ultimate eradication of Bundha parasite, at the Horticultural Research Institute, Saharanpur, aims at finding out the extent and intensity of infection in the area under investigation, eradicating the parasite and finding out the number of physiological races that may exist in the area. Out of the 148 different hosts found so far in Saharanpur and Dehra Dun districts, many are important fruit trees (and some have been reported for the first time). The following control measures were undertaken with variable results :

(*i*) Pruning—The parasite as well as the burr were pruned and the pruned parts were pasted with one of the following: (*a*) Ostic, (*b*) Grease, (*c*) Paraffin oil. The pastes produced very conflicting results, as only some of the younger parasites were killed while vigorous ones resprouted within two to three months.

(*ii*) Injections—Injections also gave varied results. Two 4-D killed the parasite in most of the cases but proved very toxic to *Mangifera indica* L., *Citrus aurantifolia* Swingle, and *Psidium guajava* L. Sodium salt of 2, 4-D, Fernoxone, and potassium salt of 2, 4, 5-T proved even more toxic to the hosts; while maleic hydrazide injections were ineffective. Other chemical injections were less effective than 2, 4-D or its sodium salt and they were also toxic to some of the hosts. For instance, copper sulphate was toxic to *Citrus aurantifolia* Swingle; *Callistemon lanceolatum DC* and *Achras sapota L.*, while ammonium sulphamate was highly toxic to *Mangifera indica* L.

(*iii*) Sprays—Sprays of the chemicals and plant regulators produced more or less the same effect on the host, as in the case of injections. But its effect on the parasite was more pronounced. Sprays of 0·75 per cent. 2, 4-D, sodium salt of 2, 4-D and Fernoxone killed the parasites. Maleic hydrazide sprays on the other hand, had no remarkable effect either on the parasite or on the host. In chemical sprays, only 4 per cent. ammonium thicynate killed a few of the younger parasites.

## FRUITS

### MANGO

**Manurial Trial**—At the Horticultural Research Institute, Saharanpur manurial trial was laid out in 1951 with three varieties *viz. Dusehri, Kailwa, Durgilal* and *Asaujia Deoband*, with two treatments control and complete N.P.K. fertilizer. No conclusive results are yet available but the data indicated that the manured plants were slightly better than the unmanured ones (control).

**Blossom Thinning Trial**—In order to control the biennial bearing habit in mango, an experiment on 'Blossom Thinning' was initiated at the Horticultural Research Institute, Saharanpur (U.P.). This trial was laid out in 1951 with three varieties viz., *Fajri Zafrani, Fajri White* and *Samarbehisht Chausa*. Two treatments were given: (1) control and (2) removal of 50 per cent. of blossoms in the 'on' year. The data were statistically analysed. The results of the analysis of variance indicated that *Samarbehisht Chausa* made the maximum growth and tree spread while *Fajri Zafrani* recorded the minimum development.

**Hybridization**—Hybridization work is in progress at the Horticultural Research Institute, Saharanpur. Crosses were made between *Totapari Small Red* and *Langra* with a view to transmit the regular-bearing character and lateness of the former to the *Langra* variety. No fruit was retained till maturity this year. The one $F_1$ seeding of this cross, made in 1955, has attained by now a height of 125 cm. One of the three $F_1$ seedlings of the cross *Dusehri* × *Totapari Hyderabad*, planted in 1954, fruited this year and description has been recorded of the fruit and tree characters. Similar detailed descriptions were recorded of the hybrid seedlings of the cross *Dusehri* × *Romani*, one hybrid seedling of the cross *Dusehri* × *Fajri Zafrani*, and of one hybrid seedling of the reciprocal cross, *Fajri Zafrani* × *Dusehri*.

**Physiological Studies**—Physiological studies on factors governing the root formation in cuttings and layerings of fruit trees were made at Calcutta University. Marked root-forming effects were obtained by the application of IBA (Indolebutryic acid) and NAA (Naphthaleneacetic acid) on mango layerings. The best effects were produced with a concentration of 5000 p.p.m. in lanolin and application of growth-promoting substances at the time of ringing. As between layerings made in May and June, the latter showed larger percentage of success with IBA, while with NAA the former i.e., layerings made in May gave better results. In a preliminary experiment on interaction of auxins and vitamins, amino acid and sugars with mango cuttings, indications of swelling and callus information were observed.

**Investigations on insect pests**—Investigations carried out on serious insect pests attacking fruit and fruit trees, grown in the plains of U.P., showed that Mango gall flies and Mango mealy bug were serious menace to the mango industry. Preliminary trials to control the mango gall flies (*procontarinia matteiana* Kieff & Cecc. and *Amradiplosis* spp. showed that spraying the galled leaves with 0·1 per cent. parathion emulsion, four times at weekly intervals during February before the emergence of flies, was highly effective in killing the larvae all of types of gall flies. Spraying with 0·25 per cent. D.D.T. emulsion under similar conditions was fairly effective against the larvae of *P. matteiana* and *Amrodiplosis viriidigallicola*.

Preliminary trials on the control of mango mealy bug (*Drosicha stebbingi* Green) showed that 0·1 per cent. parathion emulsion spray gave 92 per cent. mortality of nymphs and adults on the trees.

BANANA

**Varietal Collection**—In Bombay State, under the Banana Research Scheme, Ganeshkhind, 25 table and 8 cooking varieties and 6 wild types were added to the collection, bringing the total number in the collection to 143, comprising 98 table varieties, 28 cooking varieties, and 17 wild types. The botanical descriptions of the varieties are being recorded and their economic characters are under study.

**Mutants and Variations**—A variation was spotted in the Basrai variety having thicker fruits with a heavier bunch in a cultivator's field near Surat. The plant was semi-tall and the fruit and bunch characters resembled that of *Harichal*. Its suckers are being planted for further investigation.

**Hybridization**—At Ganeshkhind (Poona), preliminary data on resistance of banana varieties to 'Leaf mosaic' are being collected with a view to take up hybridisation work to evolve disease-resistant varieties. Out of the 30 varieties tested so far, five varieties viz., *China bontha*, 'Hazari', 'Malbhog', 'Tel chakrakeli' and *Musa balbisiana* showed no symptoms of the disease after inoculation. These varieties will be tested again for confirmation along with the rest of the varieties.

**Propagation Practices**—Extensive studies were undertaken on the propagation practices at the Ganeshkhind station, Poona (*i*) Studies on the utility of bits of corms as planting material revealed that various sizes of bits of corms gave the same performance as the 2 lb. whole rhizomes. The pit method of planting showed a slight advantage over the furrow method. The results were not statistically significant. (*ii*) Studies on the usefulness of various sizes of rhizomes from the primary and secondary groups as planting material showed that 1 lb. rhizomes both in the primary as well as secondary groups gave significantly better yield by weight of bunch than the 3 lb. primary rhizomes and 2 lb. secondary rhizomes although the yield by number of fruit was practically the same. In flowering, the 1 lb. primary rhizome and both the secondary rhizomes took longer time than the one and two lb. primary rhizomes. (*iii*) Studies regarding the age of sucker and season of planting showed that the growth of plants from March planting had been much better than those of June, the growth measurements being significant only in respect of the number of leaves produced.

**Cultural and Manurial Trial**—In a spacing-cum-manurial-cum-varietal trial laid out at the Ganeshkhind Station, Poona, significant results were obtained for spacing and varieties and not for manures. The close spacing gave significantly better yield per plant.

**Diseases of Banana**—Under the scheme for 'Investigation and Control of Chlorosis disease of banana' in Bombay State, preliminary survey work regarding the incidence of chlorosis of banana, was undertaken in villages selected at random in East Khandesh, Surat and Poona districts. One hundred and seventy-six villages covering 2,818 acres were surveyed. The incidence was nil in 118 villages, up to 2 per cent. in 42, 2 to 5 per cent. in 7, and 5 per cent. and above in 9 villages.

In Kerala State, investigations were under progress to find out control measures for bunchy top disease of banana. Some of the important aspects under study were: symptoms and transmission of the disease, reaction of various varieties of bananas to it, population studies of the vector *Pentalonia nigronervosa* and the host range of the virus and the vector.

Transmission tests of the virus showed that the bunchy top disease could not be transmitted to healthy plants by mechanical means. However, it could be transmitted by the infective aphid *Pentalonia nigronervosa*.

Out of 32 varieties inoculated to study their reaction to the disease symptoms developed only in the following ten varieties—*Nenthran, Polanthodan, Kali, Sirumalai, Kannan, Vannan, Adakkakannan, Patcha Montha Bathes, Thiruvanthapuram* and *Karimakadall*.

Studies on the seasonal incidence of the vector revealed that it was relatively abundant during November to January and was scarce during dry weather from January to May and heavy rains from June to August which seemed to be adverse to aphids. The period of succulent growth after the heavy rains seemed to be favourable to them.

The virus persisted throughout the life of the plant when once the plant took infection. Various plants were periodically examined to find out the alternative hosts of the virus and vector. It was found that the vector colonizes on Colocasia and occasionally occurs on Canna. No alternative hosts were observed for the virus.

## CITRUS

In Mysore State, at the Orange Research Station, Oddermottee (Coorg), 80 different varieties and species of citrus were introduced from Saharanpur and Kodur during the year thus bringing the total number in the collection to 120.

In Orissa, at Angul, so far 69 varieties have been collected inclusive of 8 varieties introduced during the year.

In the Punjab, at Bahadurgarh, 50 varieties of different kinds of citrus fruits were propagated for planting in the varietal Collection block.

**Taxonomical Studies**—Under the scheme for the description of varieties of citrus (I.C.A.R. headquarter scheme) 30 varieties were described completely and one partially in respect of vegetative characters; 45 completely in respect of floral characters; and 14 completely and 46 partially in respect of fruit characters. In addition, colour photographs of all the fruits and monochrome photographs of vegetative and floral parts of all the varieties under study were taken. Analytical studies were also undertaken of fruit juice of various varieties to determine the total soluble solids, sugar-acid ratio and the percentage of juice. New synonyms were also noted.

**Root Stock Trials**—In Bombay State, under the Citrus Fruit Research Scheme, Tharsa (Nagpur), seven rootstocks are being tried with *Nagpur Santra* as the scion. The girth measurements indicated that *Jamberi, Jatti Khatti* and *Sweet Lemon* rootstocks were associated with greater vigour of *Nagpur Santra* scion than other rootstocks. The smallest development of the crown was on *Sour Orange* stock as compared to others.

In Mysore State, at Oddermottee, in the rootstock trial, the budded mandarin plants flowered 15 to 30 days earlier than the seedlings. Preliminary data so far collected on the cumulative effect of rootstocks on the girth of scion trees and their height and volume indicated that Bough Lemon, Sour Orange, Grape-fruit and Sweet Lime, in the order mentioned, were superior to the rest in the fourth year of orchard life. Citron showed the lowest efficiency.

At Saharanpur, in rootstock trial on mandarin (*C. reticulata Blanco*), the results showed *Florida Rough*, *Italian 76* and *Kharna Khatta* rootstocks recording maximum growth in order of merit. Srinagar mandarin produced the maximum growth, followed by *Rangtra* and *Hill* mandarin. In rootstock trial with sweet orange scion (*C. sinensis Osbeck*), *Kharna Khatta* recorded the maximum growth. Among the scions, *Vanille* recorded the maximum growth, followed by Mosambi and *Navzlencia*.

**Manurial Trials**—In Bombay State, at Tharsa (Nagpur) Station, the girth data collected for the manurial trial indicated that the trees receiving nitrogen were more vigorous than the trees receiving no nitrogen.

In Orissa, at Angul, manurial trials were laid out in 1950 in *Nagpur Santra* to find out a suitable combination of N.P. and K in the forms of ammonium sulphate, super-phosphate and muriate of potash respectively. The height and girth measurements are annually being taken for analysing the main effect and interaction of the treatments.

In Mysore State at the Orange Research Station, Oddermottee (Coorg), in manurial requirement trials with seedling mandarins, 30 per cent. of the trees flowered and uniform stand of trees attained for giving the different manurial doses in the coming year.

In the Punjab, at Government Fruit Research Station, Bahadurgarh, plant material of Blood Red variety of *Malta* was prepared employing scion from mother trees of known quality, vigour and productivity, on uniform rough-lemon seedlings for laying out manurial trials.

In the Punjab, at Attari (District Amritsar), comprehensive manurial trials in sweet orange, grape fruit and sweet lime are in progress. Main observations under different treatments were as follows: (*i*) in Sweet Orange ammonium sulphate alone was at par with ammonium sulphate plus F.Y.M. in crop production by number and weight but was significantly better than F.Y.M. alone and control in this respect. *Hamlin* variety gave significantly better results in crop production by number than *Valencia Late*, *Blood Red* and *Common* varieties and by weight over *Blood Red* variety. As regards vigour, different manurial treatments failed to produce any significant difference in girth, height and tree-spread, the results being in descending order of F.Y.M. plus ammonium sulphate, F.Y.M. and control. *Valencia Late* developed significantly more stem-girth over other varieties.

Various manurial treatments under study failed to produce significant differences in respect of juice production by weight and juice, peel and rag formation by volume and acidity percentage. However, the results were in favour of ammonium sulphate plus F.Y.M. in improving the quality of fruit.

Different varieties under trial behaved alike in respect of total soluble solids in the juice. (*ii*) In Sweet Lime the two treatments (a) 'Senji' alone and (b) 'Senji' plus ammonium sulphate, induced significantly more yield in number of fruits over ammonium sulphate alone, but regarding weight of fruit, 'Senji' plus ammonium sulphate gave significantly more yield than ammonium sulphate alone. (*iii*) In grape-fruit different treatments and different varieties under trial failed to show any significant difference in respect of yield by number or by weight. Similarly, in respect of vigour, the different treatments failed to show any significant difference amongst themselves, but the results were mostly in favour of the treatment of ammonium sulphate plus superphosphate. As regards the quality of fruit represented by juice and rag percentages by weight and peel, juice and rag percentages by volume, different fertilizer treatments failed to give any significant difference amongst themselves. All the same, the quality of fruit was somewhat improved by the application of a combination of ammonium sulphate and potash.

**Irrigation Trials**—An experiment was laid out at Oddermottee (Coorg) in 1954, to ascertain whether irrigation with and without nitrogenous manures during drought any beneficial effect in respect of vigour, longevity and productive capacity of the trees. The results indicated a significant response to the application of water with and without nitrogenous manures.

**Pests and Diseases**—In U.P. citrus leaf miner (Phyllocnistis citrella Station) was effectively controlled by spraying at fortnightly intervals with 0·25 per cent. D.D.T. emulsion or with D.D.T. in nicotine sulphate soap-emulsion (4 lb. of 50 per cent. D.D.T. wettable powder, 1 lb. of 40 per cent. nicotine sulphate and 4 lb. soap in 80 gallons of water) or with 2 and 3 per cent. kerosene soap-emulsion ($1\frac{1}{4}$ lb. of 40 per cent. nicotine sulphate per 100 gallons of kerosene oil emulsion), during July-October. Parathion emulsion (0·05 per cent.) gave excellent results during rainy season against the miner.

A co-ordinated scheme on the study of citrus die-back disease was in progress in Bombay and Mysore States. Studies in Bombay State showed that the citrus plants were affected by a number of virus diseases like psorosis, xyloporosis and tristeza, etc. and that even healthy trees were carrying the virus. The chemical composition of leaf samples showed abnormally low concentration of magnesium and relatively high concentration of potash and phosphorous. The spraying of plants with various micro-nutrients proved helpful. The trees affected especially by sudden wilt showed degeneration of sieve tubes of the stock, thus suggesting interference in translocation of carbohydrates to lower parts of roots. This was confirmed by the carbohydrate content of various parts of roots.

Similar studies in Coorg, Mysore state, revealed that citrus decline in Thithimathi zone was suspected mainly due to root and bark diseases and in Kutta zone the main problem was orange stem borer, *Chelidonium cinctum* Guer. In a split-plot experiment to study micro-nutrient spray individually and in suitable combinations with basal dressings of three major elements as soil application, no significant difference was observed in plants. Incidence of chlorosis was the lowest in no irrigation plots and the highest in weekly irrigation plots. Intensity of symptoms of chlorosis was low in plants receiving zinc molybdenum, magnesium and copper sprays.

Analysis of samples of healthy and diseased leaves showed that healthy leaves of all ages had more of ash, N.P.K.Ca. and Mg. It was a very interesting trend and further studies are being pursued. Feeler experiment to find out the response of young citrus plants to phosphate showed that application of super phosphate and rock phosphate gave significant increase in growth.

At the I.A.R.I. centre, the work relating to the standardization of technique in respect of plant culture for experimental study and of determining contents of micro-elements was continued. An improvment was made in the method of raising seedlings under water culture by a change in *p*H from 6·5 to 4·5 for healthy growth of roots and shoots. In the estimation of iron by the absorption method using U.V. Spectrophotometer, it was found that citrus leaf samples up to two grams weight could safely be taken for estimation of iron. Description and reproductibility symptoms due to deficiency as well as excess of microelements were observed. Symptoms were noted due to the deficiency of manganese and iron. Symptoms due to zinc and copper deficiency could not be obtained. Study of interaction between micro-elements and major nutrients showed that in the interaction between boron and phosphorous, symptoms due to boron deficiency were found to be comparatively mild when 'P' was also deficient.

GUAVA

**Rootstock Trial**—At the Horticultural Research Station, Saharanpur, rootstock trial was laid out in 1954 with three treatments—(*a*) *Safeda* grafted on the airlayered stock of *Seedless* guava; (*b*) *Safeda Seedlings*, and (*c*) *Safeda* grafted on the seedling rootstock of *Safeda*. The result by the analysis of variance showed significant difference between the treatments. *Safeda Seedlings* had the maximum scion girth. The grafted plants on air-layered stock of *Seedless* were better than those on the seedling stocks of *Safeda*.

**Hybridization**—At Saharanpur, inter-varietal crosses were made between *Allahabadi Safeda* and *Seedless*, *Lucknow* 49 × *Allahabadi Safeda* and also *Allahabadi Safeda* × *Lucknow 49*, with a view to transfer the less seedy character of the *Seedless* and *Lucknow 49* to *Allahabadi Safeda*. F1 seedlings from these crosses are being raised.

**Pollination Studies**—Study of the pollination in relation to seed content was continued at Saharanpur. It was observed that fruit set from flowers enclosed in bags had lesser seeds as compared to the fruit set under natural conditions or from flowers pollinated artificially. This was true for both the flower flushes, i.e., March-April as well as August-September. Further investigations are in progress to reach definite conclusions.

**Diseases**—A scheme for the identification of and finding out control measures for a serious disease of guava, is in progress near Pushkar in Ajmer. The disease is manifested by the reduction in size of plant, interveinal chlorosis, leathery leaves and dieback of branches. It has been established that the disease is caused due to nutritional deficiency of zinc and the application of zinc sulphate at 1 lb. in 16 gallons of water with 0·7 lb. of hydrated lime, as a spray, cures the disease. The treated plants gave increased yield of guava fruit.

To detemine the most effective time of spray, correct interval and number of sprayings, optimum dose of application of zinc sulphate through soil and trunk injection for curing the disease, experiments were conducted in Ajmer. In summer *Vs.* winter spraying trials, spraying of Znso 4 (Pure) at an interval of two months gave beneficial effect as compared to control. Injection of zinc metal through holes in the trunk of the trees did not show any beneficial effect in curing the disease. It was also found that three sprayings with Nu 'Z' (a ready to use product) at the rate of 1 lb. in 50 gallons of water and zinc sulphate (pure) at the prescribed rates cured the diseased plants.

In West Bengal, to study the wilt disease of guava, a large number of isolations were made from plants of different ages as well as different parts of plants. For purpose of isolations, diseased vascular tissues were chosen. In all, 910 isolations were made from approximately 100 wilted guava plants of varying ages both from the stem region as well as the root region (460 samples from the stem and 450 samples from the root). From the stem region 45 per cent. of the isolations were of *Fusarium solani*, whereas from roots, approximately 90 per cent. of cases of isolation were of *Rhizoctonia bataticola*. In all 200 isolates of *F. Solani* and 380 isolates of *R. bataticola* were obtained.

A study of the effect of temperature on Saubaurd's glucose agar showed that *F. solani* preferred to have its optimum growth at a lower temperature than *R. bataticola*.

PAPAYA

In-breeding work is in progress at the Horticultural Research Institute, Saharanpur, with a view to purify the selected parental lines and to produce superior female progeny plants of only two varieties. *Honey Dew Ceylon Ramnagar* and *Honey Dew Agra*, were available for this work for the fourth time and three local selections for the second round. There was much variation in the fruit characters of the inbred 'varieties' and it would take many more years before they can be stabilized.

LITCHI

A rootstock trial on litchi with four combinations was laid out in 1955 at the Horticultural Research Institute, Saharanpur, in order to study the performance of *Calcuttia* and *Late Seedless* varieties on their own roots and on seedling rootstocks of *Dehradun* variety. The four different combinations were: (*i*) *Calcuttia* grafted on seedling rootstock of *Dehradun* variety, (*ii*) *Late Seedless* grafted on seedling rootstock of *Dehradun* variety, (*iii*) Airlayered stock of *Calcuttia* and (*iv*) Airlayered stock of *Seedless*. The analysis of variance of growth records showed significant difference between the treatments. Airlayered stocks of *Seedless* had the maximum girth as in the last year. Airlayered stocks were better than the scions grafted on the seedling ones. Grafted plants of *Calcuttia* variety showed faster growth than the grafted plants of *Seedless* variety.

**Insect Pests**—In U.P., preliminary spraying trials to control litchi trees infested with adult moths of *Inderbela* spp. showed that one spraying with 0·10 per cent. parathion emulsion in June reduced their population up to 96·79 per cent.

BER

In the rootstock trials being conducted at the Government Fruit Research Station, Bahadurgarh, Patiala, growth measurements of *ber* seedlings of six different types of rootstocks grown were continued. These seedlings were budded with 'Umran' scion in all the cases. The percentage of bud take was 57·2 per cent. After a survey fruit trees of fifteen promising varieties were earmarked for the varietal collection block at Bahadurgarh. Description of fruit and data of physico-chemical analysis of the various varieties selected have been recorded.

Under the rootstock trial in Saurashtra (Bombay State), it was observed that *Deshi Round Big* was the most vigorous rootstock, *Kharik* second and *Surati* produced moderate growth in pot culture.

The data recorded on the relative response of different rootstock seedlings to the 'headed back' treatment showed that Variety *Surati* put forth the maximum growth in length; *Kharik* coming next, and *Deshi Round Big* last, which was leading in vigour, in pot culture.

In Madhya Pradesh, trees of *Zizyphus jujuba* (oval fruited), *Zizyphus jujuba* (round fruited) and *Zizyphus rotundifolia* were marked for their outstanding performance, at Silari Farm. Ripe fruits were collected from these marked trees and fruits of *Ghot Ber* were procured for raising seedlings. Budded plants of *Nagpur Ber* were also planted.

POMEGRANATE

In U.P., investigations were carried out to find out the control measures of *Anar* butterfly (*Virachola isocrates* Fab.). It was observed that bagging fruits in thin or *jali* type cloth bags from the time of their setting in March till the end of July was very effective in preventing damage from the borer. Allowing the bags to remain on fruits during rainy season caused rotting of fruits. Spraying the fruits with 0·1 per cent. parathion emulsion or 1·5 per cent. ovicide (a proprietary tar oil wash) at fortnightly interval during May-June, gave about 25 to 42 per cent. reduction in bored fruits as compared to control.

DATE-PALM

Under the Date-palm Scheme at Abohar in the Punjab, 673 suckers have been collected or imported so far. The characters of the suckers collected from within the country have been noted and their varieties identified.

APPLE

In Himachal Pradesh, at the Temperate Fruit Research Station, Mashobra, 22 apple varieties (including 18 varieties imported from Russia) were added to the collection of varieties, bringing the total number to 114. Girth measurements of individual trees of all varieties were recorded and, on this basis they were tentatively grouped into three categories, i.e., vigorous growers, medium growers and weak growers.

**Rootstock Trial**—Under rootstock trials, three scion varieties namely *Red Delicious*, *Golden Delicious* and *Granny Smith* worked on six rootstocks, namely *Red Delicious*, *Golden Delicious*, *Royal Delicious*, *Ruspippin*, *C. Madhuban* and *C. Jhalti*, were planted.

Under the propagation trial on apple at the Dry Fruits Research Sub-Station, Chini (H.P.), shield budding during four months, i.e., June, July, August and September and cleft-grafting during January and February were compared. Results showed that June budding gave significantly higher success than grafting in January and February and budding in August. Budding in September was better than grafting in January and budding in August but was at par with budding in July and grafting in February and budding in August gave significantly higher percentage of success than grafting in January, the difference among the former three treatments not being significant. Grafting in January was a total failure.

**Diseases**—Study of apple mosaic in Kumaon regions of U.P. showed that its incidence ranges from 20 to 40 per cent. in the orchards. *King*, *Jonathan*, *Delicious* and *Tomkin* varieties were found to be more susceptible than others. Similar studies on an apple rosette did not give any definite conclusions.

PLUMS

Study of virus diseases was in progress in stone fruits and other hill fruits in the Kumaon regions of U.P. It was observed that Line Pattern disease of plums was very serious in these regions and nearly 80 per cent. of *Ramgarh Maynad* trees were infected. In other varieties e.g., *Maynard*, *Sharpe's Early*, *Japanese Plum* and *Greengage*, the infection varied from 35 to 80 per cent. It was capable of damaging the peach also. More than one strain of the virus seems to be involved.

OTHER TEMPERATE FRUITS

At the Temperate Fruit Research Station, Mashobra, the total number of varieties of temperate fruits collected so far, including apple, numbered 254. Girth measurements of individual trees of all the varieties of almond, apricot, cherry, peach, plum, pear, persimmon were recorded and they were tentatively grouped into three categories i.e., vigorous, medium grower and weak growers.

At Chini, germination trials with cherry seed showed that storing the seed and subjecting it to low temperature in winter before sowing in February gave the maximum germination of 90 per cent.

At the Government Fruit Research Station, Kandaghat, 135 plants of *New Castle* variety of apricot, and 140 plants of *Santa Rosa* variety of plum were planted. Promising varieties of temperate region fruits were collected and established at the Station.

**Preservation and Storage of Fruits by the Use of Hormones and Chemicals**—Under the co-ordinated scheme for the preservation and storage of fruits and vegetables by the use of hormones and chemicals, results indicated that in Assam the waxy composition used (7·5 per cent. emulsion of Dr. Sharma's fungicidal wax) was efficacious for treating *mandar* in fruits (fully ripe—late season) in the preservation of oranges.

At Poona, the effect of various concentrations of the fungicidal waxy compound on the storage life of *Alphonso* and *Pairi* varieties of mango, was studied. The results showed that the fruits when treated with more than 8 per cent. concentration of the waxy compound, did not ripen properly and the

organoleptic quality was adversely affected. Concentrations from 4 to 8 per cent helped in improving the quality of the fruit both in external appearance and in taste and flavour. In the case of banana, the waxy emulsion treatment had a little effect, though not appreciable, in improving the external appearance. The edible quality of the fruit remained unaffected. In general, the storage life of mango and banana was in no way appreciably prolonged by the use of the fungicidal waxy compound as compared with the untreated fruits.

**Chemical Composition and Nutritive Value of Indian Fruits**—In the scheme for the investigation into chemical composition and nutritive value of Indian fruits at the Nutrition Research Laboratory, Coonoor, S. India, during the year under report, nine fruits were analysed chemically to determine the nutrient content with a view to evaluate their nutritive value. In all, 40 fruits were analysed for the purpose so far.

It was observed that Yellow Passion fruit is a good source of carotene and mulberry fruit are a good source of iron. The milk and water from 10th and 12th month coconuts were analysed. It was observed that the carbohydrate solid matter ratio showed a definite decreasing trend. No such significant changes were observed for the coconut milk. The mango kernel nuts were found to be a good source of calories and thiamine. It was further found that fresh apricots and persimmon are rich in carotene and that cherimoyer and *bael* are a good source of ribofilavin. Mulberry fruits and the dried fruits like prunes, apricots and raisins can supply iron.

**Cytogenetical investigations of Fruit Trees**—A scheme is in progress at the Calcutta University involving cytogenetical investigations of certain fruit trees with a view to their improvement through breeding. Chromosome numbers of the following species were worked out:

*Physallis peruviana* (2n=48), *Annona squamosa* (2n=14), *Annona reticulata* (2n=14), *Syzigium jambos* (2n=42), *Aegle marmelos* (2n=18), *S. jambolana* (2n=44), and *Cucumis melo* (2n=24). In S. javanica var. *alba*, noted both from somatic and meiotic studies, indicated 46 as the chromosome number and not 45 as reported by earlier workers. Similarly in *Naphelium longanum* and *Flacuntica sepiaria* (female plant) both somatic and meiotic studies showed 26 and 20 chromosomes respectively and not 30 and 22 chromosomes as reported by other workers. In *Nepholium litchi*, the present study gave 28 chromosomes, whereas another worker has reported 2n=30. The occurrence of chromosomal biotypes was also recorded in other families of plants.

Induction of polypliody was achieved in *Physalis peruviana* in seedling treatment with 0·5 and 0·25 per cent. colchicine following plugging method. Evidence of duplicated sets of chromosomes (normal 48; polyploids=96) were obtained in the colchicine treated plants.

Successful colchicine application was obtained in the perennial species viz., *S. jambos Grewia subineaualis*, *Nephelium longanum* and *Aegle marmelos*. Chromosome counts of these will be made next year.

CASHEWNUT

The schemes for the investigation on the improvement of cashewnut were working at Vengurla (Bombay), Kottarakara (Kerala) Mangalore Mysore) and Dergaon (Assam).

In Bombay State, during the year under report, seednuts of ninety types were collected from Ratnagiri, Kolaba and Kolhapur districts of Bombay State and Mysore, Andhra Pradesh and Orissa States.

In the manurial trial in Kerala State, out of about 80 young trees appearing to be of same age (7 to 8 years) 50 trees were selected in lines and were divided into 5 groups of ten each. To the first 3 groups ammonium sulphate, super phosphate and muriate of potash were applied respectively, the quantity in each case being one pound. To the fourth group a mixture of all the three fertilizers was applied and the fifth group was left as control. The trees were kept under observation. It was noted that (*a*) almost all manured plants flowered and bore nuts and (*b*) the flowering in these was comparatively 2 to 3 months earlier.

Propagation trials showed that inarching and air layering were successful methods of vegetative propagation and could be adopted on a commercial basis. The months of February, March and April were the best for doing air layers, giving 90 to 100 per cent. success. Similarly, August to January was the best period for inarching, giving 60 to 80 per cent. success.

It was also noted that out of every 100 flowers produced, only 3 per cent. were hermaphrodite. Further only 3·7 per cent. of the hermaphrodite flowers fertilized to produce apple and nuts.

Trials with rooting of shoot cuttings etiolated for varying periods before planting gave indications of promise in Mysore State. Shoot cuttings etiolated for 30 days before planting gave a mean success of 25 per cent. over 7 months period with the maximum of 40 per cent. in November 1956.

Air-layering of shoots through the method of cincturing, using Alkathene wrappers continued to be a promising method both with one-year-old and current seasons shoots. The air-layering trials to determine the optimum position of the cut, rooting media and trials with growth promoting substances were repeated and the results indicated below were confirmed.

(*a*) Shoots in trees below 10 years rooted and became available for separation earlier than those in adult trees.

(*b*) Treatment with Seradix A, gave higher percentage of success in June and induced more roots per layer.

(*c*) A cut at the node induced earlier rooting.

In order to test the efficacy of air-layering as a commercial practice, 4000 layers were prepared between March-May 1956. Of these, 3000 layers were successfully separated, thus recording a success of 75 per cent.

In inarching trials, a mean success of 60 per cent. with the maximum of 100 per cent. in November 1956 was recorded, thus confirming the previous year's findings. Inarching with the aid of Alkathene film for wrapping the root stocks continue to give encouraging results, particularly during the pre-monsoon period from January-April, when an average of 66 per cent. success was obtained which was as high as 80 per cent. in January and February. The cost of production was further reduced to Re. 0-6-0 by this method as against Re. 0-9-3 by the normal method during January-May. A new

method of inarching called 'Air-grafting' using two to three month old seedlings as rootstocks—gave encouraging results. A mean of 70 per cent. success was recorded for the operation between January to April and the cost of production of inarches worked out to Re. 0-8-0 when prepared by using rootstocks potted in grass containers and Re. 0-4-6 when prepared by using rootstocks potted in alkathene as against Re. 0-9-3 and Re. 0-6-0 respectively, when prepared by using one year old rootstocks.

Trials with the Y-cutting nurse method of grafting confirmed the results obtained during the previous year that the best season for operation was between January and April and that on an average, it was possible to obtain six grafts and six layers from 10 shoots worked. The use of alkathene film to wrap the rootstock seedlings minimized the cost of watering. The modified sidegrafting method, using alkathene film which gave some encouraging results during the previous season was pursued and a mean success of 41 per cent. was recorded over an eight month period, with the maximum of 65 per cent. in April 1957.

Blossom biological studies showed that a greater portion of the current season's flowering was distributed between December 1956 and January 1957 when 53 and 43 per cent. respectively of the shoots flowered. The percentage of perfect flowers showed an increase from 4 per cent. in 1955 and 7·5 per cent. in 1956 to 9·8 per cent. in the shoots under study. The observations on the distribution of staminate and bisexual flowers during different phases of the flowering season were generally in conformity with those recorded in 1955 and 1956 except for slight seasonal variations.

Tests confirmed that cashew pollen remained viable for 48 hours and that cashew was self-fertile. Only black and red ants among insects were found to visit the inflorescences in addition to the pest *N-elopeltis Sp.* The ants were found to carry pollen. The data recorded during the current season confirmed the observations recorded last year that the paucity of pollen due to low percentage of staminate flowers at the time of peak production of bisexual flowers was one of the reasons for the low fruit-set in cashew.

Fruit-set under natural open pollination was 1·5 per cent. as against 65 per cent. by hand pollination. Spraying the trees with water at the time of peak production of hermaphrodite flowers gave indications of increased fruit-set confirming the previous findings. A definite relationship between high yields and high percentage of bisexual flowers was also established and this was also in conformity with the previous years findings.

The maximum number of flowers and maximum number of hermaphrodite flowers and the maximum fruit-set was noticed on the eastern side. The basal shoots carried the maximum number of flowers, maximum number of hermaphrodite flowers and also had the maximum fruit-set as compared with shoots in the middle and top positions of trees.

In the Assam Scheme, about 60 lb. of cashew seednuts were obtained out of which 33½ lb. were distributed to interested growers. Some 128 seedlings were planted in the orchard.

### ALL INDIA FRUIT SHOWS

To disseminate information about the varietal wealth of different fruits grown in India for the benefit of the horticulturist, the plant breeder, the fruit grower and the public at large, the First All India Citrus Show was organised by the Council at Bangalore for Southern Zone in November, 1956 and at Delhi in December, 1956. At Bangalore, in all, 175 competitors from the States of Mysore, Bombay, Kerala, Madras and Madhya Pradesh participated. Various varieties of sweet oranges, mandarin, pummelo, grape fruit, lime and lemon and other species numbering 1,500, were exhibited. The total number of prizes awarded was 85.

In Delhi, 188 exhibitors from the States of Punjab, Himachal Pradesh, Uttar Pradesh, Delhi, Rajasthan, Bihar, Assam, West Bengal and Madhya Pradesh participated. The total number of exhibits was about 2000. In all, 125 prizes were awarded.

## VEGETABLES

In order to effect all-round improvement in the cultivation of vegetables investigations relating to varietal test, cultural practices and breeding for evolving better and disease-resistant varieties, were carried out in various States *viz.*, Punjab, Himachal Pradesh, Uttar Pradesh, Andhra Pradesh, Bombay, West Bengal, Jammu and Kashmir and Delhi during the year 1956-57.

### BRINJAL

In Himachal Pradesh at Parala Station, out of five varieties tested in a randomized replicated trial, 'Black Beauty' and 'New York Improved' proved significantly superior in yield and quality. In a non-replicated row trial with ten other varieties, Type 910-5-1-1 (Kalianpur) produced the maximum yield per plant.

In Uttar Pradesh at the Government Vegetable Research Station, Kalianpur, Kanpur, trials to find out promising types in long and round brinjals revealed type 9L0-5-1-1-1 of long brinjal and type 5310-1-1-1 of round brinjal as producing the highest yields. These experiments will be repeated to confirm the results. Crosses were also made to combine characters such as earliness, tallness, colour, high yield and disease-resistance in both the long and round types of brinjals. Seventy-six crossed fruits were obtained and their seeds extracted. Plants and fruits of F generation will be studied for the desired character.

In the Punjab, trials were undertaken at Ludhiana to find out control measures for Brinjal fruit and shoot borer (*Loucinodes Orbonalis* Guen). Trials with cover sprays of various insecticides showed that both Basudin emulsion 0·04 per cent. at ten and twenty days interval or Endrin Emulsion 0·04 per cent. at ten days' interval, when sprayed at the rate of 100 gallons per acre gave better results against this pest than other treatments.

### TOMATO

In West Bengal, at Krishnagar, under varietal trial, Hybrid No. 4 and Prosperity were found to be promising. In Uttar Pradesh at Kalianpur, *Turrialba* and *Sioux* gave the highest yield of fruit. The trial will be repeated to confirm the results.

In Himachal Pradesh, out of seven varieties tested in a replicated trial, 'Sioux' outyielded the others. In a row trial with 14 varieties, 'Best of All' and 'Hybrid 12' gave the highest yield.

**Hybridization**—In Uttar Pradesh, at Kalianpur, trials to combine several characters namely earliness, late maturity, heavy yielding capacity, high vitamin 'C' content, and disease-resistance, were made and, as a result, 27 crossed fruits were obtained. Seeds were extracted and will be studied next year for the desired characters in $F_1$ state.

In Bombay State, work on breeding for resistance to virus diseases remained in progress. *Marglobe* and *Solid Red* varieties of tomato were crossed with the wild tomato variety, *Lycopersicon pimpinllifelium* and the resistant selection of *Turrialba* respectively. Hybrids were raised. Forty-nine crosses between the other selected varieties, *i.e.*, *Solid Red*, *53—548* and *Summer Prolific* and the wild type were also made. The fruit characters of the resistant segregates used for back crossing and the female parents have been studied.

**Cultural Practices**—In West Bengal, at Kalimpong, September planting proved significantly superior to the other plantings.

**Hydroponics and Hormone Studies**—In Uttar Pradesh, under the scheme for the increase of vegetable production by the use of hydroponics and hormones, considerable work was done on tomato at the Banaras Hindu University. Comparing the soil, sand and aggregate cultures in pot experiments, it was observed that the average yield per plant was the highest in sand and the lowest in aggregate culture. However, the maximum growth was noted in the tomato grown in aggregate culture, while maturity was again earliest in sand culture.

Comparing the three culture media and different stages of maturity, highest vitamin 'C' content was found in three-fourths mature tomato grown in sand culture. Similarly, sand culture was slightly superior to other cultures as regards carbohydrate content of tomatoes.

In nutrient solutions, the largest number of fruits of Ponderosa variety per plant (i.e., 30) and the highest yield per plant by weight (i.e., 20·3 lb.) were obtained in sand culture (fed by Marsh and Shives; solution). Total sugars and reducing sugars were highest in green (i.e., 1·26 per cent.) and red tomatoes (6·3 per cent.) grown in sand culture.

Hormone trials, under the same scheme, carried out on varieties Pondersa and Large Red, and treated with three hormones IAA, OIPNPC, PAA at 10, 20 and 30 PPM concentrations gave the following results:

Doses of IAA, PAA and OIPNPC increased fruit yields significantly but did not bring about any significant gain in dry weight of fruit. The glucose content was increased significantly by all doses of PAA and OIPNPC and lower dose (10 per cent.) of IAA.

Treatment with IAA at all the three concentrations, OIPNPC at 30 ppm, and PAA at 10 and 20 ppm. brought about a significant fall in the percentage of starch.

The *pH* of the juice from hormone-treated fruit fell significantly with 30 ppm. OIPNPC, and with all the three concentrations of PAA and 20 ppm. of IAA. Titrable acidity rose significantly with all the hormone treatments. OIPNPC at 30 ppm. produced the maximum concentration of total nitrogen and protein nitrogen.

Significant rise in potassium content was noted with 20 and 30 ppm IAA, 20 ppm OIPNPC and 30 ppm PAA. The percentage of phosphorous, however, did not increase significantly over control.

All harmone treatments significantly affected the calcium metabolism of the fruits. A significant gain in vitamin C was also evident.

Economics of this experiment were worked out and showed that in hydroponics, the cost of raising tomato per acre (containing 2000 plants) for pot culture fed with Hoagland and Synder solution was about Rs. 624 as against an income of about Rs. 1,666. On the other hand, income from tomatoes grown in soil culture was only about half this sum.

### CAULIFLOWER

In West Bengal, at Krishnagar and Kalimpong under varietal trial, *Snowball* and *Dania* varieties were found to be promising. At Kalimpong, October planting was found to be significantly superior over other plantings. Scooping out of the central portion in cauliflower head was found to be necessary for success in seed formation.

In Uttar Pradesh, at Kalianpur, 52 promising selections of early, medium and late maturing types were made along with 58 new samples for uniformity head-size and compactness. Promising selections will be further studied.

In Himachal Pradesh, at Parala in replicated trial with four varieties *Indian Snow Ball* and *Patna Late* gave the best performance in the order given, as regards yield and quality. At Dhaula Kuan, *Patna Late* appeared promising on the whole.

### CABBAGE

In West Bengal, at Krishnagar under varietal trial, *Eclipse Drum Head—Late Duch* and English *Ball* (Kalimpong raised) were found to be promising.

In Himachal Pradesh, out of five varieties tested, '*Pride of India*' gave maximum average weight per head. The variety *Golden Acre* was the earliest to be ready for market (in 60 to 70 days), followed by '*Pride of India*' which took 70 to 75 days.

### BHINDI

In Uttar Pradesh, at Kalianpur a varietal trial was conducted with 4 promising selections. Types 511-43-1 gave the highest yield of fruit.

In Bombay State, experiments were in progress on breeding for resistance to yellow vein mosaic virus disease. Twelve accession lines with resistance percentage varying from 35 to 75 per cent. were selected for further study out of a progeny (F4) of 94 resistant accession lines. The F5 progenies of these resistant accession lines were raised during the summer season.

In Himachal Pradesh at Parala, out of the six varieties grown under randomized replicated trial *Pusa Makhmali* was the earliest to fruit being ready after 57 days of sowing. At Krishnagar in West Bengal, April planting was found to be superior to other plantings.

PEAS

In Uttar Pradesh, at the Government Vegetable Research Station, Kalianpur, under varietal trial, *Blue Bentam*, N.P. 29 and C.P. *III* produced the maximum yield.

In Himachal Pradesh, in a replicated randomized trial with eight varieties, *N.P. 29* and *T. 19* gave significantly higher yield than others. In row trial with 29 varieties, Dwarf topped the list with regard to yield, followed by *Laxton Progress* and *N.P. 29*.

In Uttar Pradesh, at the Banaras Hindu University under the scheme for research on the increased production of vegetables by hydroponics, it was observed that, in various cultures tried, pea plants matured earliest in soil, followed by sand and aggregate culture. Mature seeds harvested from aggregate culture had the highest nitrogen and legumin content, next best being soil and lowest sand culture.

BEANS

In Himachal Pradesh at Parala, six varieties of beans were put under randomized replicated trial. No significant difference in yield could be found amongst different varieties. As regards quality, *Black Prince* (*VBSS*), *Stringless* (*Cooper*) and *Giant Stringless* (*VBSS*) were found to be outstanding and earlier varieties. Out of another set of 11 varieties grown in a non-replicated new trial, *Bountiful* (*Mr. Sanders*) variety was the earliest (coming into pods in 48 days), and *Kentacky Wonder* (*Mr. Sanders*) gave the highest yield.

RADISH

In Himachal Pradesh at Parala, out of the 11 varieties of radish put under randomized replicated trial, *T. 383*, *Chinese* and *Long White* (*L.R. Bros*) gave high yields. As regards quality T. 383 and *Chinese* varieties proved better than others. Under Dhaula Kuan conditions, *Chinese* (*I.A.R.I.*) and *White Long* (*Pachmarhi*) outyielded the other varieties. At Kalimpong in West Bengal, *Tibetan* and *Chinese* E.C. 383 were found to be promising varieties.

TURNIP

In Himachal Pradesh, out of the five varieties tried, under randomized replicated trial, *E.C. 6762* and *Purple Trop*, did comparatively well under Parala conditions, and *P.T.W. Globe* and *Purple Trop* at Dhaula Kuan. Under row trial, *Snow Ball* gave the highest yield.

GOURDS

In Uttar Pradesh, at the Government Vegetable Research Station, Kalianpur, *5123-2-3-1-1* of bottle gourd, *5236-1-1* of ridge gourd, *5235-2-1* and *5601-1* of sponge gourd, *T1* and *4910-2-1-5* of pumpkin, were found to be promising selections.

In Madhya Pradesh, at the State Mechanised Farm, Kuthulia, Rewa, under varietal trial, bottle gourd *All season* variety of Sita Ram and Co., Fyzabad; Red gourd Hot season variety of Sita Ram And Co., Fyzabad; and Bitter gourd Karilla variety of Pocha and Sons, gave the best performances.

### LEAFY VEGETABLES

In Bombay State collection and selection was in progress on leafy vegetables.

(a) **Methi for leaf (Trigonella foemum-graceum L)**—Under varietal trials, selection Nos. 34, 11, 27, 4 and 10 were found to be significantly superior to the local varieties.

(b) **Palak (Spinacea oleracea L)**—Selection Nos. *51/16, 56/8m, 56/10, 50/21* and *53/14* were significantly superior to local varieties. All these selections were late-flowering and gave 12 to 13 cuttings.

(c) **Chakwat (Chanepodium album L)**—Selection Nos, *18* and *19*, were found to be significantly superior to the local varieties.

Studies on nutritive value of leafy vegetables, showed that selection No. 8 in Methi for leaf, though not high yielding, was found to contain a high vitamin C content (181·5 mgm/100 gm.). Seed multiplication of this variety will be taken up for distribution purposes.

### KNOL KHOL

In Himachal Pradesh at Dhaula Kuan under row trial, *Large Green* (*L.R. Bros.*) *White Vienna* (*Mr. Sanders*) and *White Vienna* (*V.B.B.S.*) were found to be better in quality than the other two i.e., *Early White Vienna* and *White Vienna* (*Pocha*) although all the five varieties were promising as regards yield.

### ONION

In Himachal Pradesh, at Dhaula Kuan, under row trial, Red *Globe 6* (*N.M.S.F.*) gave the highest yield. At Krishnagar in West Bengal, October planting was found to be superior to other plantings.

In Uttar Pradesh at Kalianpur, in all, 4500 selected bulbs of Red Round, Red Flat, White Round, American Yellow Flat and Oblong Red have been retained for selfing and evolving better varieties.

### MUSK MELON

Under the co-ordinated scheme for the improvement of musk melons at the I.A.R.I., New Delhi, trials were under way to study plant and fruit characters of 35 exotic and 95 indigenous types collected. Studies on the flowering and fruit setting showed that the time taken to set fruit varied from 30 to 51 days at Delhi; and from 49 to 65 days at Kalianpur. Lucknow types i.e., IC 4130, IC 3548 and IC 4157 were early to set fruit at both the places.

Under studies on sex ratio, a value was obtained by dividing the total number of male flowers by total number of female flowers. The value ranged from 4·8 to 50 in the collections. The types with lowest value were satisfactory in bearing, as expected. In the matter of bearing, Lucknow types viz., *I.C. 3550*, IC 3549, *IC 4066* produced 8 fruits per plant, this being the highest

number. The sugar content studies revealed 4 to 15 per cent. sugar in indigenous material and 6 to 12 per cent. in exotic types. Some of the Lucknow types had high sugar content.

The Lucknow group was promising in possessing desirable characters like earliness, good bearing and high sugar content. Selfing for the maintenance of pure cultures was obtained in 25 indigenous and 11 exotic types.

In Uttar Pradesh at Kalianpur, varietal studies revealed *I.C. 3554, 4129, 4157* and *4165* from the musk melon group and *I.C. 2409, 2421, 2812, 3906, 4677, 4678, 5622, 6195, 6197, 6735 self, 6735 O.P. 6776* from the water melon group to possess desired characters.

### WATER MELON

Under the co-ordinated scheme for the improvement of water melons, at I.A.R.I., New Delhi, 73 exotic and 20 indigenous varieties were collected. Their plant and fruit characters were studied. At Delhi, Rhode Island Red was found to be the earliest, taking only 45 days to set that fruit, Midget taking 65 days. Indigenous types took 69 to 81 days to set first fruit. At Kalianpur, time of first fruiting ranged from 53 to 58 days.

In sex ratio as calculated under musk melon, the value ranged from 12·4 to 79. The sugar content in exotic types varied from 4 to 12 per cent. and in indigenous material from 6 to 10 per cent. Fruits with less than 8 per cent. sugar were found to be definitely inferior and these with 10 per cent. easily acceptable. Those with 12 per cent. sugar were definitely outstanding. Selfed seed was obtained in 23 exotic and 4 indigenous types at Delhi. Tetrapliods of varieties *Farrukhabadi* and *A sahb Yamato* were produced by treating the seedlings with 4 per cent. colchicine. Some Japanese triploid varieties produced almost seedless fruit of good quality.

Promising types in water melons were: *Midget, Otome, Diamara, Yamato, Ashi Yamato, Ice box, Rhode Island Red* and indigenous types viz., *Farrukhabadi,* and few selections from Ambals. At Kalianpur, *EC10073* and *4675* were found to be promising.

### CAPSICUM

In Himachal Pradesh, at Parala, out of the five varieties tried under randomised replicated trial, *California Wonder* (*Sutton*) *Chinese Giant* (*Pocha*) and *Chinese Giant* (*Parkash*) gave significantly higher yield than other varieties. *Chinese Giant* (*Pocha*) was earliest to be ready for market. Under Dhaula Kuan Conditions *Prize Takar* and *Chinese Giant* (*New Model Seed Farms*) yielded well.

Seed of all the vegetables was successfully raised at Parala in Himachal Pradesh, except Cabbage. Seed of four cabbage varieties was produced in isolated blocks at places of higher altitude than Parala.

Trials conducted at different farms in West Bengal with seeds raised under the scheme for research on improvement of vegetables, have been found promising.

## TUBER CROPS

### SWEET POTATO (IPOMEA BATATAS)

In Mysore State, forty-two varieties collected from several parts of the Indian Union and exotic varieties from several countries *viz.*, Ceylon, China, Philippines and the U.S.A. were being studied. About 2760 seedlings were raised locally. The superiority of *Hosur green* was established by its giving 25 per cent. higher yield over the local varieties. It is hardy and its roots are of good size and regular shape.

In Bihar, out of nine I.A.R.I. varieties tested against local varieties, *V4* significantly outyielded some varieties. However, the yield differences between *V4*, Cross *X14*, *V15*, *V36* and *V16* were not found to be significant. A yield trial with five local, four American and one hybrid variety i.e., *Cross 4*, was conducted at Musheri and Sepaya to assess their suitability. At Musheri, *SP Lalka* and *Cross 4* outyielded other varieties significantly. At Sepaya, the yield differences amongst various varieties tried were not found to be significant but *Cross 4* was the heaviest yielder.

In Bombay State, at the Agricultural Research Station Padegaon (North Satara), the trials proved that *B-4004* was much superior in yield to all the previous varieties of the Bombay Agricultural Department. It was also proved that *B-4004* is richer in crude proteins and sugars than the previous varieties evolved at the Station. The variety *B-4004* has been released for general cultivation and is now becoming very popular with the cultivators.

**Cultural Trials**—In Mysore State, preliminary observations showed that good yield of sweet potato could be obtained when sets were planted in flat beds with rows 3 feet apart and plants 9 inches apart in the row.

In Kerala State, 1 ft. spacing between plants was found to give better yields than 2 ft. and 3 ft. spacings. Under the trials of two different methods of planting i.e., on ridges and flat beds, no significant difference was noted.

In Bombay State, studies were made on the method of planting of sets and the choice of the planting material. The results showed that planting of tops of vines on both the sides of the ridges (the width of the ridge being 2 feet) increased the yield.

**Manurial Trials**—In Mysore State, under manurial trials the basal dressing of F.Y.M. and green manure were found to be very beneficial to sweet potato particularly the latter. Among the fertilizers, the application of ammonium sulphate increased the yields substantially. The effect of potash was not so marked, though the yield were slightly enhanced. The application of phosphates gave no response.

In Kerala State, considerable response to increased doses of potash and phosphorous was noticed, while there was no such response to higher doses of nitrogen.

In Bihar, a manurial trial was conducted to test the effect of different organic and inorganic manures. No significant difference among the treatments or their interactions was observed. The experiment will be repeated with modification of the application of the fertilizers.

TAPIOCA

In Bombay State, among the varieties tried at Phondaghat (District Ratnagiri) the varieties *Kovilville* and *Kavalchiddi* were found better than the local varieties *Kumta* and *Kalhapur*.

In Kerala State, a new variety collected from the hilly tracts of South Travancore, locally known as ' Kappivella ' was added to the existing collection. Eighteen strains were finally selected from the inter-varietal hybrids. Considerable progress was made in the line of selection from the hybrids between inbred and interspecific backcross types.

Under cultural experiments, planting on ridges was found to be significantly better than planting on mounds. The best results were obtained by planting on ridges at two feet spacing in average fertile soils.

The results of manurial experiments revealed that the response to increase doses of nitrogen and potash was significant but the effect of phosphorus was not so significant.

Under growth studies, chemical analysis of the tubers of twelve different varieties showed variation in the percentage of starch with the age of the tuber. The percentage of starch reached a maximum at a particular stage during growth depending on variety and decreased thereafter.

COLOCASIA

Studies at Niphad (District Nasik) and Kopergaon (District Ahmednagar), Bombay State, have shown that culture Nos. *2*, *12*, *36* and *46* and *Warm 1* were superior to others.

At the University of Kerala, Trivandrum, cytological studies showed *Colocasia esculents* as having 2n=42 chromosomes; *Colocasia antiquorum* as having 2n=28, *Caladium bicolor* as having 2n=30; *Steoudnera discolor*, 2n=56; Typhonium divarictum, 2n=52 and 2n=65, *Theriophorum* minutum 2n=16, etc., Morphological studies of the miscellaneous tuber crops and related plants were also made.

ALTI ALOCACIA INDICA

Under varietal trials at Sabour in Bihar, *K10* significantly outyielded other varieties. Under manurial trials, nitrogen applied at 60 lb. per acre significantly increased the tuber yield.

Plant and row spacing trials showed that three-inch spacing between plant to plant in rows, one foot apart, gave significant better yields.

Fifty single plant selections were made, based on their yield performance to be tested in replicated design.

SUTHANI (DIOSCOREA FASCICULATA)

Yield trials in Bihar showed that *NS-11-9A* was the highest yielder. Trials to test the tuber yield differences between whole tubers, tubers in two parts and tubers in many parts with distinct eyes, showed that whole tuber treatments outyielded the other two treatments significantly.

A spacing-cum-manurial trial showed that plants spaced six inches apart with nitrogen applied at 20 lb. per acre gave significant results as regards tuber yield. Twenty single plant selections were made on the basis of their tuber yield for testing in replicated design.

HALDI (CURCUMA LONGA)

A spacing trial in Bihar showed that 6 inches spacing was significantly better than 9 inches and 12 inches spacings.

Seventy-three single plant selections have been made on the basis of their yield performance for testing in replicated design.

**Pests and Diseases**—At the Government Vegetable Research Station, Kalianpur (U.P.), Folidol emulsion at the minimum strength of 2 drops per pint of water and Diazinon (Basudin) at the minimum strength of 25 drops per pint of water gave complete control of aphids on cole crops and radish crop within 24 hours of application, without any phytotoxio effect, provided control measures were taken in the initial stages of the incidence. Aldrin applied to the soil at one lb. per acre at sowing time considerably delayed the incidence of fruit fly on musk melon crop.

At Ludhiana (Punjab), trials were arranged to control cut worms (*Agrotis* spp.) by mixing different soil insecticides before sowing potato crop. Results showed Aldrin emulsion dust at the rate of 1½ lb. per acre as superior to other treatments. Trials to control melon fruit fly (*Dacus cucurbitae* Cog.) proved that Endrin emulsion 0·02 per cent. was better than other treatments in bringing down the incidence of fruit fly attack.

**CONDIMENTS AND SPICES**

In the scheme entitled 'Studies on Indian Spices' at the Botany Department, Calcutta University, West Bengal, an analysis of the karyotypes revealed the following:

In *Carum Carvi* (2n : 20), chromosomes were mostly long in shape. Two pairs of chromosomes were much shorter than the other pairs. Two pairs of long chromosomes bore secondary constrictions. Constrictions were mostly median to sub-median.

In *Apium graveolens* (2 : 22), chromosomes could be divided into four pairs of long and seven pairs of medium-sized to short chromosomes. Two pairs bore secondary constrictions. Constrictions were mostly sub-median.

In *Trigonella foenum-fraecum* (2n : 16), Chromosomes could be divided into six pairs of long to medium-sized and two pairs of comparatively short chromosomes. Two long pairs of chromosomes bore secondary constrictions. Primary constrictions were nearly sub-median.

In *Nentha Viridis* (2n : 12), chromosomes were mostly medium-sized and characterized by median to nearly median primary constrictions. Secondary constrictions were present in three pairs of chromosomes.

In *Nigellasative* (2n : 12), chromosomes were long in shape with nearly median primary constrictions. One pair of medium sized and two pairs of long chromosomes bore subterminal primary constrictions.

*Seeds of Coriandrum sativum, Foeniculum vulgare, Pencedanum sowa, Carum copticum. Trigonella foenum-graecum and Nigella sativa* were soaked in 0·1, 0·2, 0·25 and 0·5 per cent. aqueous solution of Colchicine for different periods up to 24 hours. After thorough washing, seeds were allowed to grow in plots.

Polyploidy was achieved in *Trigonella foenum-graecum, Foeniculum vulgara* and *Pencedanum sowa.* Of all the concentrations of Colchicine applied, only 0·5, 0·2 and 0·25 per cent. solutions were found to be successful in inducing polyploid cells.

Colchicine solutions (0·1, 0·2, 0·25 and 0·5 per cent.) were used by plugging method on the growing points of the seedlings and floral shoots of *Coriandrum sativum, Foeniculum vulgre,* and *Pencedanum sowa, Carum copticum, Nigella sativa* and *trigonella foenum-graecum* for varying periods upto 24 hours. Only 0·5, 0·25 and 0·2 per cent. solutions were found to be successful in inducing polyploid cells. But in 0·5 per cent. concentration, seedlings died after two weeks.

The polyploid plants obtained thereby (18 per cent. in *Trigonella foenum-graecum*, 22 per cent. in *Nigella sativae*, 40 per cent. in *Carum copticum*, 36 per cent. in *Pencedanum sowa*, 35 per cent. in *Coriandrum sativum*, 20 per cent. in *Foeniculum vulgare*), showed smaller nodes and internodes and slight gigantism in leaf character. Chromosome numbers, showing polyploidy, were determined both from leaf tip smears as well as from P.M.Cs. In addition to polyploid chromosome numbers, aneuploid numbers in the P. M. Cs. were also obtained. Such aneuploid numbers possibly originated out of non-disjunction in the pre-meiotic somatic cells as a consequence of disturbance in the mitotic mechanism.

Seed setting in the polyploid plants, as compared to controls, was found to be very low and was 12 per cent. in *Coriandrum sativum*, 7 per cent. in *Foeniculum vulgare*, 6 per cent. in *Carum copticum*, 15 per cent. in *Nigella sativa* and 12 per cent. in *Trigonella foenum-graecum*. Seeds, in general, were large, but variation in size was also noticed. These will be germinated in the coming winter.

In addition to the shoot-treatment, seed treatment was performed in all the species with concentrations at varying periods of treatment. Percentage of germination was found to be highly affected and only 0·2 per cent. treatment in *Trigonella Foenum-greacum* and *Nigella sativa* (during the later part of this year) was found to yield viable polyploid plants. In other cases, though polyploid plants were raised, they did not survive till flowering.

**Caffeine Treatment on Seeds, and floral shoots**—Caffeine in different concentrations following different periods of treatments, was applied to seeds, seedlings and floral shoots of the different spices. Success, however, was obtained in two varieties of *Coriandrum Sativum* following treatment with 0·5 per cent. solution. Seed-setting in C. *sativum* following Caffeine treatment was found to be 15 per cent. in the small variety and 12 per cent. in the Madrasi variety. As with colchicine, swelling of nodes and internodes, curling of leave as well as much thicker leaves was obtained. This chemical seemed to be a good substitute for Colchicine and treatments in lower dilutions will be tried in winter.

**X-ray treatment :** Treatment with X-ray, at dosages of 250r and 500r were performed last year on seeds and floral shoots and meiotic irregularities were recorded. Approximate percentages of seed-setting following irradiation of the different species were :

| | (in 250r) | (in 500r) |
|---|---|---|
| *Carum copticum* . . . . . | 4% | 3·2% |
| *C. Roxburghianum* . . . . . | 12% | 8·1% |
| *Coriandrum sativum* . . . . . | 11·5% | 10% |
| *Pencedanum sowa* . . . . . | 14·2% | 6% |
| *Cuminum cyminum* . . . . . | 19% | 7% |
| *T. foenum-graecum* . . . . . | 9·8% | 4% |
| *Nigella sativa* . . . . . | 15% | 12% |

Percentage of germination of the seeds was very low. Only two plants of *Carum copticum*, one of *C. roxburghianum*, five of *Coriandrum sativum*, nine of *Feoniculum vulgare*, two of *Pencedanum sowa* and six of T. *foenum-graecum* were obtained. It appears that irradiation at low dosage was perhaps necessary, which will be done in winter.

CARDAMOM

Schemes for the improvement of cardamom were working at two locations *viz.* Pampadanpara (Mysore) and at Nongpoh (Assam).

The general condition of the nursery in Mysore State was quite satisfactory. The percentage of germination was 90·7 of the total number of seeds sown. It is expected that over 25,000 seedlings would become available for planting in the field during 1958-59.

In Assam some 3½ lb. of cardamom seeds (small size) were obtained from Mysore for raising the seedling. Another indent for 3 lb. of seeds (larger size) was placed.

PEPPER

Schemes for the improvement of pepper were in progress at Vallayani (Kerala) and at Dergaon (Assam). In all 507 samples of pepper were collected in Kerala, of which 200 were samples of green pepper from growers, 200 of dried pepper from growers, 54 of ungarbled pepper from exporters' godown, 43 of garbled pepper stored for export and 10 of godown sweepings. These samples were subjected to detailed examination in the laboratory for gathering information on the presence of insects, their identity, and stages and nature and extent of damage caused. Immature stages of the insects obtained were reared in the laboratory.

Associated with green pepper was found the flea beetle *Longitarsus nigripennis*, the Di aspine scales, *Lepidosaphes* piperis and *Aspidiotus Sp.*, the mealy bug *Pseudococcus Virgatus*, the thrips *Gynaikothrips* Sp. a Tortricid caterpillar; species of *Collembola* and mites. Of these, the flea beetle and the coccids alone were found injurious to green pepper; these occurred throughout the State. However, all the insects got eliminated in the process of threshing and drying and were not present in dried pepper.

*Sitodrepa penicea*, *Lasidoerma* Sp., *Laemopholoeus minutus*, *Tribolium* Sp. *Psocids* and mites are seen in dried pepper only. The first two of these are capable of causing damage to dried pepper. All the pests were found in pepper stored by the growers as well as in exporters' godowns.

The majority of samples of garbled pepper, collected from lots ready for export, showed the presence of berries attacked by the polluflea beetle, the inadequate nature of the present standard of garbling this indicated that complete removal of such damaged berries was essential in order that a high standard of quality was maintained for the commodity.

Psocids and mites were present in large number of dried samples, including those of garbled pepper kept ready for export to foreign markets. Though these creatures did not cause any direct damage to pepper, their presence indicated that the pepper exported was not as clean as it should be. This defect has to be removed, especially when foreign markets prescribe a high standard of quality for such commodities.

About 500 local black pepper cuttings were collected in Assam locally and planted in beds for rooting out. Of 250 rooted cuttings of Cochin variety planted, 150 survived. *Erythrina indica* standards were planted before the planting of pepper vines was done.

CHILLIES

Co-ordinated and other schemes for the improvement of chillies were in progress at Kovilpatti (Madras), Malda (West Bengal) and at I.A.R.I. (New Delhi).

In spite of the natural setbacks, the crop performance in Madras was better than last year's performance. Out of the 75 extra state and 35 foreign types raised during the year, 15 of the foreign types were promising during the year, and have given good performance, recording acre yields ranging from 500 to 1,750 lb. Out of over 470 state collections, made and raised during the year, 16 adapted themselves to the conditions at Kovilpatti and recorded yields up to 2,500 lb. The South Arcot collections which are generally raised on sandy soils of the district were found to be cosmopolitan. They showed special features of thrip resistance, in addition to giving good yield.

So far, seeds of 115 varieties of chillies were collected in West Bengal. Seeds of 76 varieties of these were sown in the field. Detailed study of the varieties collected is in progress.

About 40 Chilli varieties were tested at I.A.R.I., New Delhi for their resistance to the Chilli mosaic virus and twenty-four varieties were found to be susceptible. Varieties Buri Red, Puri Orange, RS8 and Cuttack Red Pendent were found to be resistant.

The transmission of Chilli mosaic virus by *Aphis gossypii Glov.* was confirmed.

*Myzus persicæ* and *Aphis evonymi* were found to be additional vectors of the virus. The studies on the relationship of the virus and itsblctor, *Aphis gossypii* revealed that even a single viruliferous aphid was capafe of transmitting the virus. The acquisition and inoculation threshold wasound to be

30 second. Pre-acquisition starvation of the aphids increased and post-infection starvation decreased the efficiency of the vector. The virus was found to be non-persistent in its vector.

Host range studies on the chilli mosaic virus were in progress. The virus could not be transmitted to *Amaranthus gangeticul* and *A. virdis*, nor were these found to be symptomless carriers. Inoculation of cucurbit hosts and Aster species has also been undertaken.

The causal organism of the bacterial leaf spot was isolated and identified as *Xanthomonas vesicatoriš*.

### MEDICINAL PLANTS

Studies on methods and practices for the successful cultivation of medicinal plants including essential-oil bearing plants, Indian British Pharmacopoial plants, substitutes for British Pharmacopoial plants and important medicinal plants used in the Ayurvedic and Unani systems of medicine, are in progress under the Medicinal Plants Scheme in the States of Assam, Jammu and Kashmir State, West Bengal and the Forest Research Institute, Dehra Dun.

In Assam, more species were tried at both the centres i.e. Shillong and Nangpot with and without sheds. Designs of manurial experiments with *Digitalis purpurea*, *Chrysanthemum cinararaefolium*, *Rauwolfia serpentina* were made and experiments were started during 1956-57. Large scale plantings of *Digitalis purpurea*, *Chrysanthemum cinararaefolium Ocimum kilimandscharicum*, *Chenopedium ambrosoides*, *Mentha arvensis* were done during 1956-57.

In Jammu and Kashmir, work was done on *Atropa acuminata*, *Digitaliss purpurea*, *Dioscorea deltoidea Wall Rauwolfia serpentina* Benth, *Rauwolfia canescens*, *Anethum graveolens* Linn, *Anacylus pyrethrun* and other miscellaneous medicinal plants.

In studies on the effect of various fertilizers on the yield and alkaloidal percentages in *Atropa acuminata*, it has been found that application of super phosphate and ammonium sulphate in equal proportions had beneficial effect when both were applied in equal proportions. Combination of superphosphate and Chilean nitrate in any ratio reduced the green yield. Under propagation studies it was found that there was much higher mortality i.e., about 60 per cent. in the flat beds than in the raised beds during the early spring when the snow melted. There was also water-logging due to frequent rains.

An experiment was laid to find out whether *Digtalis purpurea* could be planted in between the belladonna rows as an intermediate cash crop without affecting the yield of belladonna for that period. The same number of beladonna plants were planted in the two plots except that in one case there were additional plants of *Digitalis purpurea* in between the rows of belladonna plants. It was observed that there was marked difference in yield of green leaves in the two cases; the belladonna crop from the beds with *Digitalis purpurea* was very poor.

It has also been observed that forest humus has a very beneficial effect on the green yield of *Digitalis purpurea* which, on an average, was ten time more than that of the control plot. Application of superphosp*lis purpurea*, as ammonium sulphate also increased the green yield of *Digita*humus. Applica- compared to control, but the yield was as high as in the case of humus. Application of Chilean nitrate produced deleterious effect and the yield was reduced.

Experimental cultivation on *Dioscorea deltoidea* Wall was started at the two field research stations at Jammu (900 ft.) and Katra (3,000 ft.). The plant came up at both the places but the development of tubers at Katra was very poor due to poor and gravelly soil. At Jammu, the growth of the plant was very good and the development of tubers maximum in a loamy soil to which large quantity of humus was added. The diosgenin contents of the tubers from Jammu has also been much higher than those from Katra. It was further found that the *Dioscorea deltoidea* Wall could be easily cultivated from 2 to 3 in. tubers, with a growing tip, planted in loamy soil to which large quantities of humus was added. The tubers were spaced 2 ft. apart. The best time for planting the tubers was early spring. The best time for harvesting the crop was when the tubers were dormant. The crop for commercial utilization was obtained after the third year of the planting.

*Rauwolfia serpentina* Benth is an important medicinal plant because of the potent hypotensive and sedative alkaloids found in its roots. One of the causes of low percentage of germination of *R. serpentina* seeds is their sterility. In 1956-57, attempts were made to cultivate the plant by shoot cuttings; shoot cuttings five inches thick and about six inches long were planted in spring in a nursery bed to which a good amount of humus had been added. These cuttings started sprouting in a fortnight and required regular watering. The sprouting was more than 50 per cent. The cuttings established roots in two months' time. When the roots were well established and cuttings were sufficiently strong they were planted in the field with spacing of $2\frac{1}{2}$ ft. among the plants. The roots of one-year, two-year and three-year old plants raised at the Jammu Field Research Station were analysed for their alkaloidal content and were found up to official standards. From these investigations, it is clear that *R. serpentina* can be successfully cultivated in Jammu and Kashmir State. It was also found that the roots of the plants raised from seeds procured from different sources possessed different percentages of alkaloids.

The seeds of *Rauwolfia canescens* from the cuttings obtained from Mungpoo, West Bengal, showed a fair rate of germination when sown at Jammu. All the planted seedlings survived.

Farm-yard manure, chilean nitrate, ammonium sulphate, superphosphate and lime were applied to *Anethum graveolens* Linn. during 1956-57. The maximum yield of seed was obtained from those plants which were given farmyard manure; next came superphosphate control, ammonium sulphate and chilean nitrate. The yield in the case of ammonium sulphate and chilean nitrate was much less than in the control plots. It was also observed that there was maximum increase in yield of oil in the case of ammonium sulphate and superphosphate, while the maximum carvone content was reached in the case of farm-yard manure. The variations in the percentage were, however, not significant. The properties of the oil were the same in all cases.

A small quantity of seeds of *Anacylus pyrethrum* was procured from Algeria and sown at the Field Research Station in Jammu. Seeds germinated after about a fortnight but the development of the seedlings was very slow in the beginning. The plants exhibited normal growth and started flowering.

Under the Medicinal plants Cultivation Scheme, Chakrata and Dehra Dun area experimental cultivation of the following medicinal plants was continued during 1956-57:—

*Rauwolfia serpentina* (Linn) Benth. ex Kurz, Podophyllum Royle, *Rhammus purshiana* DC., *Duboisia myoporeides* R. Br., D. *leichhardtii* F. Muell., *Mentha piperita* Linn., *M. arvensis* Linn., *Urginea maritima* (Linn.) Baker, *artemisi spp., Chrysanthemum cinerariifoilum* Vis., *Atropa acuminata* Royle *ex* Lindl., *A. belladonna* Linn., *Hyoscyamus niger* Linn., *Ephedra gerardiana* Wall., *Eucalyptus polybractea* R.T. Baker., *E. cneorifolia* DC., *Aconitum heterophyllum* Wall., and *Ammi visnage* Lam.

In the case of *Rauwolfia serpentina,* it was confirmed that for root production it was best to raise the plants through seeds.

Cultivation of *Artemisia brevisolia* under forestry conditions at and near Kathian was increased by 4 acres, bringing the total area there to 8½ acres under this species. The experiments indicated that better growth could be obtained in a good soil. Flowering was profuse and 12 oz. of viable seeds were collected. Samples analysed during the year showed a santonin content of upto 1·85 per cent. which was considered a high figure.

In the case of *Atropa acuminata,* it was observed in manurial experiments that the alkaloidal content was the highest when the flower buds were in the primordial stage.

Cultural experiments on *Podophyllum hexandrum* were continued and it was observed that plants raised from the youngest part of the rhizome flowered and fruited within one year, while those raised from the older parts of the rhizome did not flower at all during this period.

Experimental planting trials were undertaken at Rango in West Bengal and at nearby places on the following plants during the year 1956-57:

1. *Acorus calamus,* 2. *Ami majus,* 3. *Atropa acuminata,* 4. *Atropa belladonna,* 5. *Digitalis purpurea,* 6. *Digitalis lanata,* 7. *Datura stramonium,* 8. *Hyoscyamus niger and H. muticus,* 9. *Mentha piperita,* 10. *Mentha arvensis,* 11. *Ocimum kilimandocharicum,* 12. *Ocimum basilicum,* 13. *Pyrethrum,* 14. *Rauwolfia serpentina* 15. *Rauwolfia densiflora,* 16. *Rauwolfia canescens* and 17. *Asparagus maritimus.*

Harmone experiments on the rooting of *Rauwolfia serpentina* and *Rauwolfia canescens* showed that root development was initiated in harmone-treated cuttings, which gave out longer, thicker, and greater number of roots; but unlike *R. serpentina, R. canescens* cuttings did not produce any roots, in both the control experiments of sand and soil. Moreover, in *R. canescens* the percentage of root formation was very low; it was bushy and hardier than *R. serpentina* which was short, erect and less branched. Vegetative growth of *R. serpentina* cuttings was gradual and continuous up to a limit and could keep pace with the root developments. The vegetative growth of *R. canescens* cuttings was rapid and continued up to a limit and could not keep pace with the rather slow and very scarce root development and hence the maximum percentage of the mortality. Vegetative propagation of *R. canescens* is, therefore, not advocated in this season. In a former trial, an observation after three months showed that out of 38 untreated cuttings of *R. canescens* planted in May, 1956, 19 cuttings

(or 50 per cent.) gave out roots and survived after three months in July, 1956. In the case of *R. serpentina*, however, out of the untreated cuttings planted in the same month 70 per cent. (35 : 50) struck roots and survived well after three months.

ERGOT

The Ergot schemes for the investigation of the production of Ergot, are in progress in the States of Assam and West Bengal.

Investigations in Assam to determine the effect of the number of sprayings that are required to ensure maximum infections showed that:

1. Infection was higher when the number of sprayings was increased from 4 to 8. There was, however, no marked difference in the extent of infection and the yield of sclerotia when the number of sprayings varied from 6 to 8.

2. The optimum yield of sclerotia was obtained when spraying was undertaken in the evening.

3. Strain *M-1* gave the largest percentage of infection and the maximum yield of sclerotia, and Strain *V.B.* the lowest infection and low yield of sclerotia.

4. Rye seeds sown in November showed the maximum height of plants, whereas with late sowings decrease in the height of the plants was noticed.

5. The number of tillers was highest in plants sown in November. There was decrease in the infection and yield of sclerotia with late sowing.

6. November-December appeared to be the best season for sowing rye at Gauhati.

7. The yield of sclerotia was relatively higher as compared to those obtained before, because of the increase in the number of sprayings from 8 to 12 during the flowering period of the plants.

8. Under manurial trials, cowdung proved to be the best manure in regard to the extent of growth and early flowering, higher extent of infection and higher yield of sclerotium. $N + P_2O_5 + K_2O$ was second in the series. In the control there was marked contrast in growth and yield as with cowdung.

9. Rye variety *Black Winter* showed better vegetative growth and higher percentage of infection as compared to the *Assam Rye* variety.

In West Bengal, experiments were conducted with three varieties of rye seeds and four strains of the fungus (*Claviceps purpurea*). It was observed that the Portugal strain of the fungus gave the highest yield of ergot per acre both in the experimental plots as well as bigger-size general cultivation plots at all the elevations. On a total area of 1·205 acres, it produced 165 lb. of air-dried Ergot, or a yield of 137·5 lb. per acre.

As regards the variety of seeds used to raise rye population in relation to Ergot yield, there appeared to be no significant superiority of one variety over the other used in these experiments. Conclusions derived from three years' trials are:

The optimum sowing season for the best ergot yield is mid October. Lower elevations (2,700 feet to 1,600 feet) are best suited for ergot yield. Equal proportions of water and rye seed used in the preparation of sterilized rye, give the best growth and sporulation of the fungus.

## ESSENTIAL OIL BEARING CROP PLANTS

Botanical and chemical studies of some of the important essential-oil yielding species like *ajwain* (*Trachyspermum amli L*). Sprague syn. (*Carum copticum* Benth), *dhania* (*Coriandrum sativum L.*), *jeera* (*Cumimum cyminum* L.) *sounf* (*Focniculum vulgare*, Mill) and *sua* (*Anethum graveolens* L.) remained in progress in Delhi, Jamnagar and Katrain.

Under manurial trials, a significant response to nitrogen alone was observed in *ajwain* and *sounf* at Jamnagar and only *sua* at Delhi responded to phosphate. The interaction between nitrogen and phosphate was significant only in the case of *sua* at Delhi.

Seeds of *dhania* and *sounf* were harvested at mature greer stage and at the dead ripe stage. The seeds harvested were dried in sun and shade. It appeared that, in *dhania*, the harvesting at the mature green stage did not materially alter its oil content as compared to harvesting at the dead ripe stage, although, in *sounf* the former stage of harvesting was more desirable than the latter. In both the crops, drying in the shade generally appeared to be preferable to drying in the sun.

The seeds after drying were stored in three types of containers, (1) gunny bags, (2) gunny bags with lining of paper, and (3) gunny bags with lining of alkathene. The seeds were analysed for oil content every three months. Storage of produce in gunny bags with paper lining was observed to be better than either gunny bags alone or gunny bags with alkathene lining. The percentage loss in oil content was least in gunny bags with paper lining in *dhania* while in *sounf*, gunny bags with alkathene lining proved to be the best.

## JUTE

The Jute development work, initiated in 1948-49 and continued during the First Five Year Plan, has been in progress under the Second Five Year plan as well. The target of jute production fixed for the Second Five Year Plan is 55·40 lakh bales, viz., an additional production of 13·43 lakh bales compared to the year 1955-56, when production of jute was 41·9 lakh bales. The production of jute in 1956-57, was 42·21 lakh bales. The target fixed for 1957-58 is 43·83 lakh bales, and for achieving this a sum of Rs. 14·49 lakhs was sanctioned as grant to the jute growing States. A loan of Rs. 86,818/- has also been sanctioned to the Government of Orissa for the Jute Seed Multiplication Farm. A conference of the jute growing States was convened in New Delhi in January, 1957, to consider measures to accelerate the pace for the achievement of the target of jute fixed under the plan. The important recommendations made, included more emphasis on the application of fertilizers to the jute crop, distribution of improved Jute Seeds, use of 30,000 seed drills and wheat uses for improving cultural practices, and 10,000 sprayers for plant protection measures in the jute growing States. Governments of jute growing States were assured of the supply of all extra quantities of fertilizers for top dressing of jute crop and were requested to accord high priority to the distribution arrangements, so that cultivators might not experience any difficulty in obtaining supplies of fertilizers.

**Nucleus Jute seed Multiplication Farm**—The Farm continued to function during the year. A total quantity of 62 maunds 30 seers of nucleus seeds of improved strains of jute (34 maunds *capsularis* and 28 maunds and 30 seers *olitorius*) was produced in the Farm during 1956-57, in addition to the production of 12 maunds of seed of various substitute fibre crops. During the current year, a total area of 98·9 acres has been put under jute crop, besides 28·62 acres put under substitute crops. Yield of about 75 maunds of nucleus jute seeds of improved variety is expected.

### COTTON

Cotton extension schemes are running in the States of Andhra Pradesh, Bombay, Madhya Pradesh, Madras, Mysore, Orissa, Punjab, Rajasthan and Uttar Pradesh under the Second Five Year Plan. The Central Government bears the entire expenditure of these schemes, except the losses on account of distribution of seeds which are shared in equal proportion between the Centre and the State Governments concerned. The target of cotton production fixed for the plan period is 65 lakh bales and that for 1957-58 is 50·05 lakh bales.

The All-India First Estimate of cotton, 1957-58 puts the current year's area at 14,616,000 acres, as against the corresponding adjusted estimate of 14,559,000 acres, for 1956-57.

Grants to the extent of Rs. 11·50 lakhs have been sanctioned to the States this year. A provision of Rs. 25 lakhs also exists for advancing loans to the State Governments for the purchase of improved cotton seeds during the current year. Out of this amount, a loan of Rs. 4,50 lakhs has been sanctioned to the Madras Govt. Other States who are in need of loans have not yet intimated as to when exactly they require it.

### TOBACCO

Tobacco extension schemes have so far been put into operation only in Andhra Pradesh and Bihar States under the Second Five Year Plan. Uttar Pradesh Government also intends to put the scheme into operation this year. The expenditure on these schemes is met in equal proportion between the Centre and the State Governments concerned. No quantitative target has been fixed. The aim is to improve the quality of tobacco grown in the country through intensification of research and organisation of Tobacco Extension Service.

### OILSEEDS

Oilseeds development schemes have so far been put into operation in the States of Uttar Pradesh, Madras, Bombay and Orissa under the Second Five Year Plan. The expenditure on these schemes is met in equal proportion between the Central and the State Governments concerned. Grants to the extent of Rs. 73 lakhs have been sanctioned to the States, this year so far.

The target in respect of the production of five major oilseeds, viz. groundnut rape mustard, sesamum, linseed and castor, has been fixed at 75·50 lakh tons during the Second Five Year Plan period. Thus, an additional production of 18·45 lakh tons, compared to the 1955-56 figure of 57·05 lakh tons is to be achieved by the end of the Second Five Year Plan. The production of oilseeds in the first year of the Second Plan was 60·32 lakh tons as per final estimates published by the Directorate of Economics and Statistics, New Delhi.

Lac development schemes are running in the States of Bihar, Madras, West Bengal, Orissa, the Punjab, Andhra Pradesh, Mysore, Madhya Pradesh and Uttar Pradesh under the Second Five Year Plan. The expenditure on these schemes is met in equal proportion between the Central and the State Governments concerned. Grants to the extent of Rs. 1·62 lakhs have been sanctioned to the States this year so far. The target of production of lac has been fixed at 16 lakh maunds during the Second Five Year Plan period. The production of lac during the first year of the Second Plan was 12·15 lakh maunds.

### COCONUT

Coconut development schemes have so far been put into operation in the States of Madras, West Bengal, Orissa, Kerala, Bombay and Assam. The expenditure on these schemes is shared on 50 : 50 basis by the Central and State Governments. Grants to the extent of Rs. 4·45 lakhs have been sanctioned to the States this year so far.

The target has been fixed at 80,000 tons of additional production in terms of coconut oil during the Second Five Year Plan period.

### ARECANUT

Arecanut development schemes have so far been put into operation in the States of Orissa, Assam, West Bengal and Mysore. The expenditure on these schemes is met in equal proportion by the States and the Central Governments. Grants to the extent of Rs. 26 lakhs have been sanctioned to the States this year so far.

The target of production of arecanut fixed for the Second Five Year Plan, is 27·22 lakh maunds. The target fixed for the year 1957-58 is 23·556 lakh maunds.

### AGRICULTURAL IMPLEMENTS

The All-India Report of the Survey is being compiled. Another scheme for the survey of other indigenous agricultural implements which have not already been surveyed, was sanctioned in all the States for one year with effect from April 1, 1958.

Three Central Officers will also be appointed for carrying out survey and co-ordination of the information pertaining to waterlifts, chaff cutters, groundnut decorticator rice processing equipment, threshing devices and bullock carts.

**Scheme for the award of prizes in agricultural implements**—Reports on the trials conducted on the machines entered in the Competition have so far been received from the States of (1) Punjab, (2) Bihar, (3) West Bengal. No entries for the award were registered in the States of (1) Andhra Pradesh, (2) Assam, (3) Kerala, (4) Mysore, (5) Orissa, (6) Rajasthan, (7) Delhi, (8) Himachal Pradesh and (9) Manipur. Reports of the trials are, however, awaited from the States of Bombay, Madhya Pradesh and U.P.

Necessary steps are now being taken to constitute an *ad hoc* Committee for the final award of prizes.

CHAPTER III

# ANIMAL HUSBANDRY RESEARCH

## CATTLE BREEDING

**Selective Breeding versus Grading Up**—The Council has initiated co-ordinated research on the subject with a view to finding out the relative value of selective breeding of indigenous cattle in various States as compared to their grading up with improved breeds under local climatic conditions. Schemes on the subject are operating in Orissa (two units) Bihar and West Bengal.

**Selective Breeding of Ghamsur versus Grading up with Hariana (Orissa)**—The work under this Scheme was started in January, 1947. During the year under report, 73 cows for the grading-up group were served, of which 37 were fertile services. In the selective breeding group, 79 cows were served by Ghamsur bulls, of which 33 were fertile. The recording of body-weight of the adult stock was continued; the average weight worked out to 377·3 lb. as compared to 397 lb. in the last year. The decrease in weight was due to an outbreak of foot and mouth disease. The average daily milk yield was recorded as 2 lb. 3 oz. The average lactation yield for 300 days based on milk actually obtained worked out to 622 lb. 4 oz. as against 1089·6 lb. based on complete stripping records.

During the year under report, 21 graded males and 16 graded females were born. The birth weights of the graded progeny were comparatively higher than the weight of selectively bred progeny by 7 and 6 pounds in the case of males and females respectively. The cost of milk production worked out to Re. 0-7-4 per lb. based on actual collection and Re. 0-6-4 per lb. based on complete stripping records.

**Selective Breeding of Khariar versus Grading up with Sindhi (Orissa)**—The work under this scheme was started in March 1956. The 120 cows of the foundation stock were divided into identical groups and allotted to Sindhi bulls for the grading up programme and Khariar bulls for the selective breeding programme. The milk recording was continued and complete stripping was practised once a week. The average yield per cow worked out to 2 lb. and 5 oz. based on complete stripping records. Feeding was carried out on prescribed scale of ration. The cost of milk production worked out to Re. 0-7-0 per lb. based on entire collection and Re. 0-6-6 per lb. based on stripping yield.

**Selective Breeding of Red Purnia versus Grading up with Sindhi (Bihar)**—The scheme was started on January 1, 1956. The work in this unit has not yet fully developed. Preliminary arrangements with regard to the establishment of the farm were made and 105 acres of land was acquired. The stock for the scheme was being purchased. As few animals have been acquired, work on breeding could not be carried out. Further work under this scheme was being continued.

**Selective Breeding of West Bengal cattle versus Grading up with Hariana**—The work under this scheme started in December 1956, and a part of the foundation stock was purchased. Due to an outbreak of rinderpest on the farm, the progress of the scheme was hampered and purchase of further stock was delayed. However, 251 cows were in milk from December 1956 to March 1957 and an average daily yield of 4·6 lb. was recorded. The work under this scheme was still in progress.

**Central Artificial Insemination Station, Bangalore**—This Station is one of the main artificial insemination centres for the supply of Jersey semen to cross breeding schemes run in the country. It was established in December 1954. Besides Jersey, Sindhi, Tharparker and Murrah breeds are also maintained.

There was no change in the number of bulls of different breeds stationed at this Centre. During the year under report there was a general rise in the body weight of bulls.

At present, semen is supplied to 14 centres only, but it is expected to supply semen to 20 centres by the end of September 1957.

There were 1,106 despatches consisting of 35,635 cc. of semen of Jersey bulls and 9,673 cows were inseminated, while there were 353 despatches consisting of 6,958 cc. of semen of Sindhi bulls and 188 cows were inseminated. There were 188 despatches consisting of 2,100 cc. semen of Tharparker bulls and 62 cows were inseminated, while 20 despatches consisting of 330 cc. of semen of Murrah bulls were sent and 100 inseminations were performed. Considering the number of inseminations performed, it appears that the semen of Sindhi, Tharparkar and Murrah bulls has not been fully utilised.

Semen quality was improved by the regularisation of collection, and the despatch mortality ranged between 5 and 4. Further work is in progress.

**Improvement of Kangayam Breed**—The scheme was started in July 1942, with the object of improving the milking capacity of Kangayam cows without adversely affecting the draught capacity of the males of the breed.

Initially 60 heifers between the age of 1-1/2 and 2-1/2 years and born of dams giving 2,000 lb. milk per lactation were selected as the foundation stock. The females were mated with the bulls from high milk yielding strain.

Lactation records were kept by effecting complete stripping once in a week both morning and evening. It was observed that there were 19 animals giving 2,000 lb. and above. Thirty-five were giving more than 1,000 lb. but less than 2,000 lb.; while there were six animals giving milk yield of less than 1,000 lb. During the year under report, 49 animals were either sold or discarded for different reasons and nine died.

In all, 75 bulls were distributed to the K.V. Centres and 10,711 inseminations were performed. There were 1,741 natural services and 1,988 calves resulted from these services.

The average age of maturity worked out to 43 months, while the range was 38 to 98 months. Average daily milk-yield of under massaged cows was 7·6 lb. while it was 7·3 lb. for cows whose udders were not massaged. The average fat percentage was 5·2, the range being 4·3 to 6 per cent. It was also observed

that the fat content at the end of lactation of cows was as high as 8·7 per cent. Out of 106 calves born, 48 were male calves and 58 females. The average birth weight of bull calves was 48·7 lb. and that of female calves 42·7 lb. The maximum weight of bull calves was 61 lb. and minimum weight of females as 29 lb. The sex ratio worked out to 54·7 per cent.

The average rate of increase in the weight of calves was 0·9 lb. daily the maximum being 1·3 lb. daily.

Livestock Investigation Scheme, Hissar (Punjab): This Scheme was started in April 1943, with the object of investigating the possibility of evolving a multi-purpose Hariana animal combining the two economic characters *viz.*, draught capacity and milking capacity by scientific breeding.

Experiments were conducted to investigate the milking quality of 230 Hariana cows which were selected on the basis of body conformation. It was observed that the percentage of cows giving 3,000 lb. milk and above increased from 1·2 per cent. (foundation stock) to 8·3 per cent. (progeny), while the percentage of cows giving 1,500 lb. and below decreased from 54·3 (foundation stock) to 25·0 per cent. (progeny), thus showing a definite improvement in the milk-yielding capacity of progeny. The average yield of foundation stock was 1,208·3 $\pm$ 64·6 lb. and that of first generation 1,559·4$\pm$57·1 lb. Records of 165 bulls were investigated for service behaviour and it was observed that the average reaction time varied from 2 seconds to 45 minutes with an over-all average of 8·50$\pm$0·69 minutes. Studies of the fertility rate of the bulls used on the farm for the experiment revealed that the rate of fertility did not differ much from bull to bull. The average percentage of fertile services was 53·9.

The mortality rate was 3·7 per cent. during the year. Out of 118 calvings 50 were males and 68 females. The sex ratio (number of males borne for every 100 females) worked out to 103·0 per cent. for 1,344 births recorded during the period under report.

There was a reduction of 25 days in the average calving interval as compared to previous year.

The average birth weight for male calves was 52·32$\pm$0·29 lb. and for female calves it was 49·11$\pm$20 lb. There existed a definite relation between fat variation and the season and time of milking. The heritability of milk yield for 300 days of 110 daughters was 0·50$\pm$0·12 as calculated by intra-sire dam-daughter regression method.

Co-ordinated Scheme on cross-breeding of Cattle: The co-ordinated scheme on cross-breeding of cattle in hilly and heavy rain-fall areas continued to function at ten different centres in the various States. The Council has sanctioned units in the States of Assam, Andhra Pradesh, Bihar, Kerala (2), Madras, Punjab, Manipur, Uttar Pradesh and West Bengal. Two more units will be established shortly in the States of Mysore and Andhra Pradesh.

The main objectives of the scheme are to investigate:

(*i*) the possibility of improving milk production by introduction of foreign blood;

(*ii*) the optimum proportion of foreign blood that will enable the animals to thrive and produce their best; and

(*iii*) the effect of packing, storage and transportation of semen on its motility and other qualities.

Under this scheme, breeding is done by artificial insemination with Jersey semen supplied from Central Artificial Insemination Centres, Bangalore and Calcutta. Semen is sent from these stations by air to the various units.

The work done during the year 1956-57 at the various units is described below:

*Andhra Pradesh* : *Visakhapatnam*—The scheme is in operation at this centre from July 1955. Survey of the selected area was completed, and essential items of equipment were purchased. In order to achieve affective breeding control, 714 bulls were castrated during the year under report. The Livestock Improvement Act was also enforced in the scheme area.

During the year, 182 consignments of semen were received and 571 cows were inseminated. Three hundred twenty two cows were examined for pregnancy and 151 (46·89 per cent.) were found pregnant; 63 crossbred calves were born. Milk recording work was also taken up and 620 cows were milk recorded. In all 242 cows and 12 calves were marked for identification.

*Assam* : *Shillong*—The scheme at this centre started functioning in December 1955. House-to-house survey was carried out at some places. Steps were taken to enforce the Livestock Improvement Act in the Scheme area. Generally the progress of work on all items of technical programme was slow. Efforts to intensify the work are being made.

*Bihar* : *Ranchi*—This scheme started functioning from April 1955. The supply of Jersey bull semen from Bangalore was not satisfactory owing to transport difficulties. Now semen from local Jersey bulls is being used. During the year under report, out of 445 cows that were inseminated, all cases were followed up and 183 (41 per cent.) were found pregnant. 34 cross-bred calves were born. Steps were being taken to enforce the Livestock Improvement Act in the Scheme area. Two hundred and forty-one bull calves were castrated and 306 cows milk recorded.

*Kerala* : *Chalakudy*—This scheme started functioning in April 1955. During the period under report, 1,684 inseminations were performed. Out of 781 cows that were examined for pregnancy, 259 (33 per cent.) were found pregnant; 159 calves were born. The Livestock Improvement Act was extended in the Scheme area and 192 bulls were castrated; 971 animals were marked for identification and 250 cows were milk recorded.

*Kerala* : *Neyyittinkara*—This is the second unit established in the State of Kerala. This scheme started functioning only from October, 1956. Since the work in the scheme was started late, the house-to-house survey was still in progress. The laboratory equipment was being obtained and other preliminaries were being completed to initiate work on other items of the technical programme.

*Madras* : *Ootacamund*—This unit started functioning in January 1955. During the year, 3,542 cows were milk-recorded. The Livestock Improvement Act was enforced in the area and 689 castrations were performed and only 63 bulls remained to be castrated. In all 2,663 inseminations were performed.

Out of these 549 belonged to Scheme animals and 2,114 to non-Scheme animals. Ninety-two calvings were recorded; 114 calvings were also recorded in respect of inseminations performed on non-Scheme animals; out of 1,442 cows examined for pregnancy 811 (56 per cent.) were found pregnant.

*Punjab* : *Palampur*—This unit started functioning from March 1955. Preliminary survey was completed and essential laboratory equipment was being obtained. Insemination work in main and sub-centres was started lately and 139 inseminations were performed. Steps were being taken to enforce the Livestock Improvement Act in the Scheme area. Fifty-five bulls were castrated; 265 cows were milk-recorded.

*Manipur* : *Imphal* –This unit started functioning in October 1955. Survey in the selected area was completed and all essential items of equipment were purchased. The Livestock Improvement Act could not be enforced, in the Scheme area so far. During the year, 174 bulls were castrated and 632 still remain to be castrated. At all the centres, 330 cows were milk-recorded and 289 cows were marked for identification; 84 cows were inseminated with Jersey bull semen.

*Uttar Pradesh* : *Dehra Dun*—Since the scheme came into operation from December 1956, only preliminary arrangements for selection of site for the scheme were completed. Other items of technical programme could not be taken up.

*West Bengal* : *Darjeeling*—This unit came into operation from January 1956. House-to-house survey was still in progress. Essential items of equipment were supplied. Steps were being taken to enforce the Livestock Improvement Act in the Scheme area. One hundred and Seventy bulls were castrated.

During the year under report, 200 cows were inseminated. Out of 66 cows that were examined for pregnancy, 31 (46 per cent.) were found pregnant; 242 cows were milk recorded; 585 cows were marked for identification.

### SHEEP BREEDING

A co-ordinated research programme for evolving superior wooled sheep is sponsored by the Council on a regional basis. For this purpose the sheep raising areas are divided into three main regions *viz.*, (1) the temperate Himalayans Region, (2) the dry Northern Region and (3) the Southern Region. In each region a main research centre, with substations in the adjoining States or sheep breeding areas, is being established with the cooperation of the respective State Governments. The following is the position in brief as regards the experimental breeding undertaken under the regional research scheme :

**Temperate Himalayan Region**—This region comprises hilly regions of Uttar Pradesh, the Punjab, Himachal Pradesh and Kashmir.

The policy in this region is to evolve strains of sheep which will yield apparel wool. The method to be followed is systematic cross-breeding with the rams of the imported Rambouillet Merino breeds.

U. P. Pipalkoti—In the temperate Himalayan region, the main centre is located at Pipalkoti in the upper Garhwal district of Uttar Pradesh. The grading of the Rampur Bushiar sheep with the Rambouillet rams is being carried out and this has reached second generation stage. The crossbred sheep

and the pure-bred Rambouillet stock appears to have acclimatized itself to the local conditions. Out of 18 adult Rambouillet sheep, during the mating season, 14 ewes (five imported and nine farm borer pure-bred ewes) were mated to the imported rams. In all, 21 lambs were born. A total of 66 of Rampuri Bushiar ewes and 14 Merino cross bred F. 1 ewes were mated between June-August. The average period of gestation in the Rampur Bushiar ewes worked out to 150 days and the same period of gestation was observed in the Rambouillet F. 1 ewes. The live weight of the Rambouillet cross-bred F. 1 and F. 2 lambs at birth was recorded as 5·3 lb. and 6·1 lb. respectively. On an average, the highest birth weight, of 7·9 lb. was recorded in pure-bred Rambouillet progeny.

The Rambouillet rams and ewes together with the farm born lambs are shown once in a year during the months of March and Rampur Bushiar stock together with the Merino cross-bred F. 1 and F. 2 progeny are shown in September and March. The average annual wool yield of the Rambouillet cross-bred F. 1 is 2·14 lb. and that of Rambouillet cross-bred F. 2 lambs is 3·4 lb.

During the year under report, Rambouillet cross-bred F. 1 and F. 2 pure-bred Merino rams were issued to the flock owners. By organising collective breeding centres near the stud ram centre, Baragaon, in the Niti valley, 535 local ewes were covered by the Rambouillet cross bred F. 1 rams and 87 by the pure-bred Rambouillet. At the end of the year, 30 Rambouillet C. B. F. 1 and 180 Merino quarter-bred progeny was obtained. A total of 277 improved progeny were born among the flocks with the private breeders in the Niti and Mana valleys.

Due to adverse climatic condition and heavy rainfall there was considerable mortality amongst the lambs. A total of 96 young lambs and Rampur Bushiar ewes died. The percentage of mortality worked out to 23 per cent. as against 10 per cent. of the previous year.

*Wool Laboratory*—During the year, 405 wool samples were studied from the Sheep Breeding Research Station, Pipalkoti at the Wool Analysis Laboratory, Rishikesh. In addition, the laboratory analysed 35 samples of imported Polwarth sheep as well as four bulk samples of Polwarth, Bikaneri and cross-breds comprising of ten sub-samples. Another 688 samples received from the different State farms in Uttar Pradesh were tested for medullation.

Himachal Pradesh : Sarahan—The experimental breeding of sheep at this research station is to carry out selection in a flock of Rampur Bushiar sheep for evolving a non-hairy uniform-fleeced strain and to undertake a cross breeding programme with the Rambouillet rams to ascertain whether fine-wooled sheep can be reared in this region.

This farm had a flock of 175 Rampur Bushiar ewes, a flock of 240 Polwarth sheep and a few Hissardale sheep; 51 Polwarth rams were distributed to the sheep breeders for breeding purposes. The wool samples of Rampur Bushiar ewes were sent to the Wool Research Laboratory Poona for analysis and it was observed that some sheep carried fleeces with a uniform superior staple. In the case of 57 ewes for selective and 117 for upgrading the average percentage of medullated was recorded as 2·5 per cent. and 4·47 per cent. respectively. Six sheep had medullation of over 20 per cent. The wool produced at the farm was sold to the Industries department.

KASHMIR : BANIHAL-REASI—At the Sheep Breeding Farm, Banihal-Reasi the local flocks are crossed with the Merino and Rambouillet rams with the object of producing superior fine wooled sheep. A flock of 160 Merino crossbred ewes is maintained and this was divided into two types one having 58's or above wool quality and the other 56's or below. The flock having wool quality of 58's or above, was bred to the rams of the same type while the 56's (or below) wool quality flock was bred to Dealaine Merino rams. It is expected that this flock will soon develop as a new breed which can be termed as the Kashmir Merino.

Cross breeding with the Rambouillet rams has also been undertaken. The first generation of 65 half-bred ewes was further mated to the Rambouillet rams. It was observed that the Rambouillet sheep are thriving well in the climatic and grazing conditions of the Kashmir State.

The fleeces were analysed at the wool laboratory. The sheep improvement programme among the village flocks was also carried out; 212 rams were issued to the flock owners for breeding purpose.

**Dry Northern Region**—This Scheme comprises regions of Rajasthan, South-West Punjab, Saurashtra, North Gujerat, Kutch and some parts of Western U.P.

RAJASTHAN—This is the main station in this region. The farm is to be located at Sardarshahr. The work under the scheme was not started, as the State Government did not provide the requisite land or other requirements such as the buildings, sheep pens etc. However, the necessary equipment was purchased so that the work could start immediately the land was available. At this station, selective breeding of the Bikaneri sheep is proposed to be carried out.

JORIA—This is the second centre in this region, where selective breeding amongst the two important breeds of sheep from North Gujerat viz., Kutchi-Patanwadi and Kutchi-Marwari was undertaken.

The work at this station commenced in 1953-54 with a flock of Patanwadi sheep. The Marwari flock was purchased in the previous year.

Seven rams of Kutchi-Patanwadi breed were selected for breeding. Eighty seven ewes were mated, producing 46 lambs. The fleeces of rams had 9 per cent. medullated fibres and the progeny had 19 per cent. The average fibre diameter of the fleeces of both the dams and the progeny was 30 microns.

Three rams were selected for site-mating and these were mated to 36 ewes producing 14 lambs. The fleeces of the progeny contained 24 per cent. medullated fibres as compared to 27 per cent. in the dams. The fibre diameter of the fleeces of progeny was 30·61 microns whereas the dams had 30·43 microns fibre diameter.

The fleece density in the progeny varied from 650 to 1,515 fibres per sq. cm. with an average of 909-22 while the same was 810-28 in the dams. The average wool yield was 26·75 oz. for the two clips, clean wool content being 77 per cent.

A flock of 50 Kutchi Marwari ewes was purchased and was mated to two selected rams, giving birth to 18 lambs. The fleeces of the progeny had 59 per cent. medullated fibres as compared to 50 per cent. in the dams. The fibre diameter of both the dams and the progeny was 35 microns.

Trials on a larger flock are essential in both the types of sheep to assess the quality of wool produced by the progeny. It was observed that on the average the birth weight and the rate of growth of the Kutchi-Marwari lambs, was higher as compared to Kutchi Patanwadi.

**Southern Region**—This region comprises Bombay, Mysore, Hyderabad, Madras and parts of Madhya Pradesh.

The policy in this region is to evolve new breeds of sheep carrying superior fleeces adapted to the different environmental conditions of the Deccan by the grading up of Deccan ewes by the Marinos and the use of the cross breeds for further grading up. In the Nilgiris sheep with finer wool are proposed to be evolved through selective as well as cross breeding.

Bombay : Poona—The principal research station for this region is located at Poona. The work pertaining to the breeding of selected Deccani sheep to evolve a strain of superior wooled sheep was in progress. Two Deccani rams were mated to 39 Deccani ewes and 36 lambs were born. From the results, it was observed that both the rams helped in improving the quality of wool of the progeny in regard to fibre diameter, whereas the medullation and the fleece density remained at the same level.

The average annual wool yield obtained was 24·8 oz. as against 33·5 oz. of the previous year. The low yield might be due to heavy rains.

The programme of grading the Deccani sheep with the available Merino ram was continued at the Sheep Breeding Research Station, Suttatti in Belgaum District. During the year, 22 half-bred ewes and 10 three quarter-bred ewes were mated to the ram. To study the improvement effected in the progeny dam-progeny comparisons were made. The fibre diameter in the fleeces of the progeny was 22 microns as against 29 microns for the dams. Medullation had decreased from 11 per cent. in the dams to 9 per cent. in the progeny. Thus, it was observed that the progeny of the second generation i.e. 3/4 Merino-bred sheep was found to be superior to the first generation *i.e.*, the half-bred Merino.

Inter-breeding amongst the Merino crossbreed strain was also carried out and valuable results were obtained. Three breeding lines were formed. (1) Mating of the Merino half-bred ewes to 3/4th Merino bred rams, (2) Mating of the Merino quarter-bred ewes to the 3/4th Merino bred rams, (3) Mating of the Merino quarter-bred ewes to 5/8th bred Merino rams.

For the establishment of breeding lines, 33 Deccani ewes and 18 half-bred ewes were mated to the Rambouillet rams at the Sheep Breeding Station, Suttatti, 19 and 13 lambs were born in the first and second generation respectively.

It was observed that the Rambouillet ram had helped to a great extent in improving the quality of wool of the progeny in the first and second generations, the fibre diameter being 26 and 19 microns respectively as against 37 in the Deccani ewes. The medullated fibres were also reduced from 23 per cent. in the Deccani ewes to 8 per cent. in the first generation and one per cent. in the second generation.

Breeding trials in the village flocks were also conducted.

A total of 6,523 wool samples were analysed to study the different attributes of wool quality. Normal records of grazing, weights, lambing etc. were maintained.

MADRAS : NILGIRIS—This is the second centre in this region. At this centre selective breeding and cross breeding of the Nilgiri Sheep with the Romney Marsh rams was being taken up to evolve new strains or sheep. Work is also proposed to be taken up with the Ceviot rams.

The year opened with 487 Nilgiri sheep and 10 Romney Marsh rams. For selective breeding work 257 Nilgiri sheep were mated to selected rams. The selected Nilgiri rams were mated to 245 ewes and the percentage of fertility worked out to 95·3 per cent. The average wool yield of the Nilgiri sheep was recorded as 1 lb. 3·5 oz. as compared to 1 lb. 2·5 oz. of the previous year.

For cross breeding programme, 343 ewes were allowed for mating to the Romney Marsh rams. Out of these only 156 ewes were served and 109 ewes gave birth to lambs, the fertility percentage being 69·9. As the laboratory was not fully equipped, wool analysis work pertaining to the fibre length and medullation percentage was carried out. A total of 522 wool samples were studied.

During the year, 39 selected Nilgiri rams were distributed in the rural area for the improvement of village flock.

**Eastern region**—This region comprises Bihar, Orissa, West Bengal and Assam. The policy in this region is to test the adaptability of the Romney Marsh and Gaddi breeds of sheep to the climatic conditions normally prevalent in this region and to propagate suitable breeds.

BIHAR—A scheme for research for ascertaining the adaptability of the crosses from the Romney Marsh and Gaddi breeds of sheep to the climatic conditions in Bihar, was started at Gaya in 1953. The breeding programme now pertains to the grading up of Chhotanagpur sheep with the Gaddi and also with the imported Romney Marsh rams.

During the year, a total of 60 lambs was born by crossing Chhotanagpuri ewes with the Gaddi rams. The Romney Marsh rams could be mated to 46 ewes during cold months of the year.

Average wool yield of Chhotanagpur ewes, Gaddi and Romney Marsh rams was 6·1 oz., 1 lb. and 15 oz. respectively, the average wool yield of the graded progeny being 12·5 oz.

At the Wool Analysis Laboratory, Gaya, 95 samples of wool were analysed for medullation and diameter. The average medullation of the fleeces of the Chhotanagpuri ewes was 59·7 per cent. The average diameter for the flock worked out to 47 microns. The estimates of medullation percentage of 15 F. 1 lambs of Gaddi X Chhotanagpuri breed was also carried out. It was observed that the mean value for this F.1 progeny was diameter 37 microns and medullation 48·2 per cent. as against 58·8 microns and 40·7 per cent. respectively for the dams. The higher percentage of medullation in the progeny might be due to the fact that in lambs the hairy fibres grow first and these are shed later.

ORISSA—In Orissa a scheme for the development of sheep and wool of an exploratory nature was started in April, 1946. The main item of work undertaken at the farm was the trial of Bikaneri and Lohi breeds of sheep with a view to study the problems pertaining to sheep husbandry. Though Bikaneri sheep withstood the local conditions, the scheme was closed down in 1950 due to lack of facilities. It is now proposed to utilise the existing flock by locating the scheme in a suitable place.

DEVELOPMENT OF SHEEP AND WOOL—SECOND FIVE YEAR PLAN

Based upon the results of researches conducted in the past, the I.C.A.R. has now launched a co-ordinated scheme for the development of sheep and wool in the country, under the Second Five Year Plan. The object of the scheme is to organise an intensive sheep improvement programme in selected centres with a stipulated sheep population, for evolving superior breeding stock which will contribute to the increase to sheep products in the country. The scheme envisages the establishment of 396 sheep and wool extension centres, three sheep breeding farms with a wool analysis laboratory attached to each and three wool utilisation centres during the Second Plan period. The participating States are U.P., the Punjab, Bombay, Mysore, Andhra Pradesh, Rajasthan, Himachal Pradesh, Madras, Madhya Pradesh and Jammu and Kashmir. So far, a total of 128 centres have been set up in different States.

GOVERNMENT INSTITUTE FARM, HISSAR—The Sheep Research Station at the Government Livestock Farm, Hissar is conducting work for the evolution of a woolly or clothing type of sheep through selective breeding of the existing flock of Bikaneri sheep. This Research Station was started on April 1, 1953 for a period of five years i.e., up to March 31, 1958. In view of the satisfactory work done at this research station, the Council has agreed for the continuance of the scheme for a further period of three years.

The work pertaining to the evolution of a clothing type of sheep has been in progress since 1944-45. The flock is divided into four different types—A, B, C and D, according to the quality of the flock with particular reference to medullation. Type 'A' represents flock having 0 to 20 per cent. medullation and type 'B' indicates an ideal carpet wool with 20 to 40 per cent. medullation. Type 'C' and 'D' contain a higher percentage of medullation, (over 40 per cent.) and are undesirable. Breeding is practised with the exclusive use of 'A' type rams and the progeny having undesirable characters are eliminated by the use of "Rapid Benzol Test" and also gradual elimination of D, C and B type of sheep.

The work pertaining to the standardisation of methods of measurement for the assessment of certain fleece and body characters of sheep as a pre-requisite for conducting heritability estimates of clean fleece weight, fleece covering, fleece density, fibre thickness and its variation in the fleece medullation, canary colour in fleece and body type was also being carried out at the Research Station.

A post-graduate diploma-course in sheep and wool was conducted for three consecutive years. This course was of one year's duration and a total of 18 students from different states in three batches completed the course. Presently, this training has been discontinued and it is likely that the course may start again when the need for training more students is felt.

## GOAT BREEDING

**Angora Goat Breeding Schemes**—The scheme commenced from April 1, 1950 at Gwaldom (Dist. Garhwal). Originally, the scheme was started at Pipalkoti and was shifted to Gwaldom in 1955.

The object of the scheme is to evolve under northern Indian hill conditions, a U. P. type of Angora goat suited to Himalayan region, by crossing the white long haired hill goats with the imported Angora bucks.

The flocks were reorganised at the commencement of the year under report. The available does were divided into three separate groups, each headed by a pure Angora buck. During the year only 39 kids (F4 progeny) were born. The average birth weight of the F4 Angora graded kid was 4·5 lb.

The Angora stock was fed with 8 oz. of gram or sugarbeans, 8 oz. barley and 2 oz. of common salt, while half of the same ration was fed to the graded progeny except common salt. Grazing was pactised.

The average yield of Mohair is tabulated below:

| Type | Average first shearing in oz. (Oct. clip) | Average second shearing in oz. (March clip) | Total annual yield |
|---|---|---|---|
| 1. Angora bucks .. | 56·0 | 35·0 | 91·0 |
| 2. 1st cross goats .. | 7·0 | 2·0 | 9·6 |
| 3. 2nd cross goats .. | 8·4 | 4·8 | 13·2 |
| 4. 3rd cross goats .. | 18·0 | 12·9 | 30·9 |
| 5. 4th cross goats .. | 13·5 | 8·0 | 21·5 |

It may be stated that although the results of production of Mohair in the cross bred herd were encouraging, the size of the goats in successive generations was reduced. It is proposed that the work at this station be expanded to commence large scale trials to assess the quality and quantity of Mohair in relation to meat production.

The scheme which terminated on March 31, 1958 has been further extended for a period of one year.

**Goat improvement scheme : Kerala**—The scheme was started in July, 1951 with the object of improving the Malabar goats by distribution of progeny-tested bucks for breeding purposes in several areas. Popularisation of goats' milk and economic standard rations for milk production are also envisaged.

The scheme was started with 120 does and 4 bucks and during the year under report the farm had a total of 386 goats comprising 4 bucks, 95 does of the foundation stock, 99 male and 158 female kids. Ten selected F1 bucks were distributed to panchayats, Ccoperative Societies and private individuals for conducting extension work in the districts of Kottayam, Quilon and Trivandrum. The average birth weight of male and female kids was 5 lb. 9½ oz. and 5 lb. 4⅔ oz. respectively. During the year, 187 goats completed their lactation and out of them 32 goats completed their lactation-birth a year. The average milk yield per lactation was 159 lb. 9¾ oz. The highest milk yield was recorded in goat HO 70 (346 lb. 6 oz. in a lactation of 188 days).

The scheme terminated in 1956 as there were no facilities to maintain the experimental herd. In view of the importance of breeding of goats in the State of Kerala, it is likely that work on a systematic basis may be taken up shortly.

Goat breeding is also to be taken up shortly in Bombay State for the production of meat and Mohair and for Mohair production in Himachal Pradesh. At both these places Angora goats will be used.

### POULTRY

**Poultry Development Scheme : Kerala**—The Scheme was started in 1952 for a period of five years and was extended further for a period of three years from April 1, 1956. The object of the scheme is to study the suitability of the two exotic breeds of fowls—White leghorns and Rhode Island Reds in heavy rainfall and humid climates and to upgrade *desi* fowls.

The studies on annual egg-production of the pullets, seasonal fertility and hatchability of eggs set for incubation were repeated during the year. The two breeds continued to maintain good standard of production, generation after generation. It was observed that the factors of age and season did not have much influence on the fertility and hatchability of eggs. Even the aged birds gave good fertility and hatchability during the hot months. This was probably due to the fact that all the birds were given shark-liver oil and some greens.

**Duck breeding scheme : Kerala**—This scheme was started with the object of studying the problems pertaining to duck husbandry in Kerala State. The foundation stock of the farm consisted of 50 ducks and 10 drakes (adults) of Khaki Campbell breeds brought from Haringhate farm, and 25 ducks and 31 drakes of Khaki Campbell breed, brought from the Indian Veterinary Research Institute, Izatnagar, where these were imported as day-plds from England.

In spite of the adverse influences such as change of climate and other environments, Khaki Campbell breed has been observed to mature earlier than the *desi* breed. It could be observed that if the breed is brought up under normal conditions after getting it acclimatised to the locality, it would prove better still. The egg production of the breeds was very irregular. The combined flock average was 46·2 per cent. (maximum) in the month of June and 9·4 per cent. (minimum) in December. Incubation had to be conducted when the production was at the trend of 20 to 40 per cent. Altogether 1264 eggs were incubated in 12 settings of which only 149 ducklings were hatched out. The maximum fertility observed was 80 per cent. and the minimum 14·3 per cent. Hatchability of fertile eggs ranged from 0 to 62·5 per cent. The Haringhata and I.V.R.I. stocks moulted on their arrival in January 1956. The moulting was repeated after an interval of seven months, in August 1956. This time, however, the moulting was quite intensive in the case of I.V.R.I. stock. This was probably due to the change of climate and environment and the long journeys the birds had sustained. The Haringhata stock in general was in good bodily condition during the year and the mortality was only 8·5 per cent. The I.V.R.I. stock did not keep so well and the mortality percentage was 29·2. The weakness of the I.V.R.I. stock which were direct imports from England could be attributed to their ill-adaptation to the indigenous climatic conditions.

As the fertility and hatchability of eggs was very poor, the survival of the F.1 progeny proved to be a difficult problem. Mortality of ducklings in the early stage is abnormally high and whatever survive, usually die during the third and sixth week of age. As there was not sufficient stock for replacement, general culling on the farm could not be done.

The maximum egg-weight was 3·7 oz. and the minimum 1 oz. The average was calculated to be 2·05 oz. A method for trapnesting the ducks was investigated and adopted in the farm.

**Egg-Laying trial scheme : I.V.R.I., Izatnagar**—The scheme was started under the direct supervision of the Head of the Division of Poultry Research at I.V.R.I. The object of the scheme was economic production and distribution of quality eggs and birds and to save the public from exploitation by breeders selling unworthy stock.

Pans of five birds, each belonging to one breed were received from eight different breeders in the country. The birds belonged to either Rhode Island Red or the White Leghorn breeds. Each of the five pullets were accommodated separately and housed, fed, and managed under standard conditions. An accurate record of the number of eggs produced, their size, quality and other particulars was kept for each of the birds. The maximum number of eggs laid by an individual bird was 210. The scheme has now been terminated and the certificates of merit are being awarded.

COMMERCIAL CHICK HATCHERY AND POULTRY PROCESSING

**Plant-Katpadi (Madras)**—The scheme started from June 1, 1955 with the object of investigating the possibilities of establishing a commercial hatchery and processing plant under local conditions.

Sixteen village farms have been established. Hatching eggs from these farms are being supplied to the Central Station where the chicks are hatched and reared up to certain age. A beginning has, however, been made and a number of birds were processed and sold. Demand for the frozen meat appears to be good.

**Duck breeding scheme : I.V.R.I., Izatnagar**—The main object of the scheme is to explore the possibilities of rearing and breeding of Khaki Campbell ducks without making elaborate arrangements for water. Studies on hatching, brooding rearing, mortality, feeding, growth rate, sexual maturity, egg production and water arrangements were carried out. Eggs were incubated at 99·8°F and transferred to hatchery trays. In some of the later hatches the fertile eggs were transferred to hatching trays in small still in the incubator, on the 23rd day. A towel soaked in lukewarm water was spread over the eggs on the 23rd, 24th and 25th day of incubation for about three to four hours each day. It was observed that the hatchability was slightly improved by following this practice.

The average fertility and hatchability was 60 and 33 per cent. respectively.

By practising cold breeding, mortality was reduced and growth was improved. Encouraging results were obtained by breeding ducklings under covers at 85° to 90°F. For ducklings wet mash system (without rice) was found to be satisfactory. It was, however, felt desirable to give soft diet (*viz.*, half boiled rice soaked in skimmed milk) for at least first two days.

The average weight of ducklings of parental stock at the ages of 4, 8 and 12 weeks was recorded as 16·25, 36·34 and 49·50 oz. respectively. The minimum age at sexual maturity was found to be 135 days and the maximum 177 days, the average being 149·55 days. It was observed that there is a definite correlation between egg production in 100 days and 300 days. On the basis of the above observations good ducks can be selected at an early age. Similarly, the future egg size within 300 days can also be roughly estimated from the 100 days egg-size.

**Commercial Hatchery Scheme, Y. M. C. A., Martandam (Madras)**—The scheme was initiated in the year 1957 with the object of developing a commercial hatchery for the production of 20,000 white leghorn chickens for distribution every year in selected areas. A preliminary survey has been carried out. Necessary equipment for hatching, brooding and rearing chickens has also been procured and installed. During the year under report, targets for distribution of chickens have been exceeded. The work is in progress.

**Cross breeding in poultry : Allahabad Agricultural Institute**—The scheme was started with the object of comparing the efficiency of straightforward cross breeding against recurrent reciprocal crossing in poultry with a view to collect basic information to determine a policy of breeding for commercial egg-production. Seventy eight White Leghorn hens and 70 Rhode Island Red hens were obtained for the experiments. Fourteen Leghorn and 14 Rhode Island Red Cocks were mated with these hens. Five to Seven hens were allotted to one cock and each group of cock and hens were maintained in a separate pen during the entire breeding period. The eggs collected were hatched. It was, however, observed that egg from W.L.H. × R.I.R. had greater percentage of fertile eggs. The percentage of mortality in the case of chicks varied from 15 to 25 per cent. giving an average of 19·6 per cent. The higher percentage of mortality may be attributed to the inadequate housing accommodation which was later on improved.

**Influence of climate on the performance of desi Fowls, Orissa**—The scheme commenced from 1st January 1953 and continued up to 31st March 1957. The object of the scheme was to study under diverse conditions of soil and climate the performance of improved strains of *desi* fowls developed by the Indian Veterinary Research Institute, Izatnagar. Persistency records of 70 birds were studied. It was observed that the birds in the higher persistency record had better annual egg production averages and along with the decrease in the former, there was a decrease in the latter. Trapnest record of 77 birds that completed their first year of lay during the entire period of the scheme was maintained. Out of these birds 20 were taken from the foundation stock received from the Institute on 1st January, 1953 and the remaining 57 were hatched at Angul during 1953-54 and 1954-55. Amongst the 20 birds of the foundation stock of the Institute the average annual production was 119·50 and the average egg weight 1·624 oz. The average egg production per bird among 57 birds that were hatched at Angual was 121·912 and the average egg weight 1·581 oz. It was observed that a large percentage of birds matured quite early. The birds which attained sexual maturity earlier had better annual egg-production. Broodiness of 77 birds that completed their first laying year was recorded and it was observed that the average egg-production of broody birds was 106·720 and that of non-broody birds 126·826.

Out of the total number of 126 pullets raised during the entire period of the scheme, 91 were Brown Leg Horn type, 14 were partidge type and 21 other types. As regards colour of the shank 108 had yellow shank and 18 had dark shanks. Incidence of moulting was observed in 73 birds. It has been observed that most of the birds started moulting during the months of May and June under Orissa conditions and most of them continued to lay even while moulting.

The percentages of fertility and hatchability were 62·458 and 72·903 respectively. The results obtained in these respects during 1955-56 and 1956-57 were very poor and this low percentage was probably due to continuous in breeding. As regards sex ratio, 447 chicks were sexed, out of which 51·677 per cent. males and 48·323 per cent. females. The average food consumption of 100 chicks up to 24 weeks worked out to 166·806 lb. The average food consumption of adult birds per day during 1954-55 was 2·719 oz. and during 1955-56 it was 3·382 oz. As regards growth rate, the average body weight of chicks of 1953-54 hatches of 0 days, 8th week, 16th week and 24th week were 1·195 oz., 9·992 oz., 26·340 oz., 39·524 oz., and 44·535 oz. respectively.

Out of total number of 629 chicks hatched during the entire period of the scheme, 223 chicks died of different diseases such as pneumonia, heat stroke, peritonitis, Juptuze of liver, heliminthic infestations and avian elencosis complex and due to some obscure diseases etc. etc. Studies on dam-daughter comparison and comparative value of sires were made and it was observed that in general there does not appear to be any decline in the production of daughters as compared to their dams. The same holds good in case of comparative value of sires *i.e.*, there is little difference in the production of dams and daughters of the same sire. The studies on body weight and egg-weight indicated that there exist variations in the relationship between these two characters.

### DISEASE CONTROL

Schemes for investigation of the diseases of cattle and buffaloes, sheep, goats and poultry, as well as a number of schemes on specific disease problems, continued to function in the States and at the Indian Veterinary Research Institute, Mukteswar and Izatnagar. Their progress reports and technical programmes were scrutinised and co-ordinated by the Council as before.

**Bovine Mastitis**—The co-ordinated scheme for the investigation of bovine mastitis functioned at the Indian Veterinary Research Institute and in the States of Uttar Pradesh, Madras and Bombay.

The object of the scheme is (*i*) to determine by suitable diagnostic methods the extent of the prevalence of the disease, (*ii*) to find out the relative incidence and importance of different organisms involved in the causation of the disease and (*iii*) to assess the efficacy of various methods of treatment and control, considering their applicability and cost.

*Uttar Pradesh*—In Uttar Pradesh, a preliminary survey on five livestock farms revealed variable incidence of clinical mastitis. Up to 16·4 per cent. of the cows and 20 per cent. of the buffaloes were affected in individual herds. A study of successive lactations of the affected animals revealed a fall of 15 to 25 per cent. in milk yield and shortening of the lactation period. Out of 361

animals (189 cows and 172 buffaloes) taken up for systematic study in one herd, the incidence of mastitis was 31·7 per cent. in cows and 4·3 per cent. in buffaloes, with 14 per cent. of the cows and 8·6 per cent. of the buffaloes having blind teats. Injuryto the orifice of the teats appeared to predispose to infection. Among the diagnostic tests, there was 100 per cent. correlation between the cultural examination and the leucocytic count. Of the various other tests, the White side test gave the highest percentage of accuracy. Cultural examination of milk samples revealed that *Staph. albus*, *Staph, aurous*, *streptococci agalactiae*, *Str. dysgalactiae*, *Str. urberis*, *Str. pyogenes*, non-haemolytic diphtheroids and Baterium *coli* were responsible for the disease in this herd. Quarters infected with *Str. agalactiae*, *Str. Dysgalactiae*, *Staph. aureus*, *Staph. albus*. and *B. coli* in sub-clinical or clinical stages of mastitis were successfully treated with terramycin. Combinations of penicillion, streptomycin and sulphamezathine were found to be effective against *Str. dysgalactiae*, *Str. uberis*, *Str. pyogenes*, *anaerobic Stroptecocei Staph. aurous*, *Staph. Albus*, *B. coli* and mixed infections, but *Str. pyogenese and Str. uberis* resisted treatment.

In the State of Bombay, 151 animals (91 cows and 60 buffaloes) were examined, among which 19 blind teats were observed, 11 in cows and 8 in buffaloes. In all, 588 samples of milk were collected, 366 from the cows and 232 from the buffaloes. From these were isolated 41 *Str. agalactiae*, 34 *Str. dysgalactiae*, 26 *Srt. uberis*, 13 *Staph. aurous*, 4 *C. pyogenes* and 1 *Str. pyogenes*. In addition 221 milk samples from 83 buffaloes, 38 cows and 10 goats affected with clinical mastitis or under treatment were also subjected to cultural examination. The affected animals were treated with penicillin, combination of pencillin, dihydrostreptomycin, sulphamezathine (with or without cobalt sulphate), terramycin and masticillin with successful results in most cases.

The Indian Veterinary Research Institute centre continued to undertake investigations on mastitis, besides helping the State Centres in typing the causal organisms isolated from infected udders. Of the various indirect studies, the leucocytic count, the simplified chloride test, microscopic examination of gravity cream, and the plate White side test have encouraging results in the order mentioned. Out of 196 milk samples from 49 cows and 48 milk samples from 12 buffaloes of one herd, 90 cultures were isolated. Of these 61 animals, 15 cows and 5 buffaloes were found to be infected with one or more organisms. These included *Str. dysgalactiae* in six cows, *Str. uberis* in five cows and *Staph. aurous* in eight cows and three buffaloes, besides a number of coagulase-negative staphylococci and other organisms. A small-scale trial treatment with penicillin in oil, with 1·5 per cent. aluminium monostearate supplied by M/s. Hindustan Antibiotics Ltd., Pimpri, was undertaken in six animals, of which four became culturally negative one month after treatment. Two animals clinically infected with *Staph. aureus* and two more animals infected with this organism as well as *Str. agalactiae*, were successfully treated with procaine penicillin, dihydro-streptomycin, and cobalt sulphate administered for four days at 24 hour intervals.

The scheme in Madras started operating during the year under report.

**Hump sore**—The co-ordinated scheme for investigating the life-cycle of the causative parasite and developing suitable measures for control and treatment has been sanctioned in the States of West Bengal, Orissa and Assam.

In West Bengal, the incidence of the sore was surveyed in almost all the districts, and the infection was found to be prevalent in all the districts surveyed except the Darjeeling district. Cattle usually over two years of age were found affected and sores were observed in all the seasons of the years, but somewhat more commonly during April and May. The animals imported from the other States appeared to be more susceptible than the local cattle, and in one case about 90 per cent. of the cattle purchased from the Punjab developed hump sore within one to two years of their arrival in West Bengal. Adult parasited and their larvae were collected from several regions and their morphology was studied. Microfilariae were detected in the peripheral blood of 6 out of 182 cattle affected with hump sore and in 3 out of 408 catltle having no sore. These microfilariae, however, appeared to be different from that of *S. assamensis*. Over 8,000 winged arthropods collected from cattle sheds and from the body of the affected animals were dissected. Living Larvae were encountered in 34 specimens of *Musca* and in one specimen of *culex*. The indentification of these larvae was in progress. Direct transplantation of living larvae collected from the sores could not reproduce the disease in unaffected animals. Similarly, *Musca* flies, bred clean in the laboratory and allowed to feed on hump sore lesions and later on mechanical injuries produced on clean hump of unaffected animals, failed to transmit the infection. Treatment with hetrazan, antimosan, anthiomaline and ethylchloride spray was unsuccessful.

In Orissa, 1391 cattle were found affected with the sore in a survey covering 16,660 cattle, including 2,000 buffaloes. The incidence was higher and the lesions more raw in the summer and the rainy season than in winter. Usually, animals four years and above in age were found affected and no animal younger than 1 year 10 months was found affected with the sore. The incidence rate was the highest among the Hariana and Sindhi bulls and among the graded bullocks. Several adult worms and their larvae were subjected to detailed morphological study. Filarial larvae were detected in 124 mosquitoes, 2 *Musca* flies and 2 *Stomoxys* flies out of a total of 1,208 specimens of a variety of arthropods dissected. In one animal housed continuously in a fly-proof shed, the sore healed up spontaneously within two months treatment with hetrazan ointment was undertaken in 240 animals, and in a majority of these the lesions healed up, though they recurred in a number of cases.

The scheme in Assam has not yet started functioning.

**Brucellosis**—Schemes for the investigation of brucellosis were sanctioned in the States of Uttar Pradesh, Madras, Bihar and Orissa, with a view to determining the incidence of brucellosis and allied infections and developing suitable control measures.

In Uttar Pradesh, 5,433 animals over six months in age were tested; of these 3·4 per cent. gave positive agglutination reaction and 2·8 per cent. gave suspicious reaction. The reactors included 8·4 per cent. male uncastrated animals, and 3·9 per cent. bullocks. The incidence of infection was slightly more in cattle than in buffaloes. In one state farm, where calfhood vaccination is being done

since 1951, the incidence of infection came down to 11·32 per cent. from the initial 30·94 per cent. Out of the 937 bulls (cattle and buffaloes) tested, 1·7 per cent. were positive reactors. In one herd, almost all the abortions occurring during the past five years could be traced to a single bull. In a series of 59 positive reactors, only 27·1 per cent. of the animals were found to give a positive reaction on retest after a period of five years. There was considerable correlation between the milk ring test and blood serum agglutination test. The vaginal mucus test was found to be positive in only those animals whose blood serum agglutination titre was 1/200 and above.

The schemes in Madras and Bihar have started recently, but not yet in Orissa.

**Lumbar paralysis**—The scheme for investigating the aetiology of lumbar paralysis continued to function in Orissa. As before, this condition was observed mainly in Beetal goats imported from the Punjab and in their graded progeny. It was found to be prevalent in hilly and heavy rainfall areas, abounding in forests and was encountered especially during winter months. No microfilariae could be detected in peritoneal fluid of healthy cattle and goats or in the cerebrospinal fluid and brain suspensions of affected goats. Similarly, no parasites could be detected in serial sections of the brain and spinal cord of four affected goats and three healthy goats. Attempts to reproduce the disease in Swiss albino mice by intracranial injections of cerebro-spinal fluid collected from eight goats affected with lumbar paralysis proved futile.

**Retention of placenta**—A scheme for investigating into the incidence of retention of placenta and determining the bacterial flora of tubular genitalia in bovines, in Orissa started functioning from the 13th December, 1955. In a series of 65 calvings in cows on one organised farm, the placenta was retained in 9·23 per cent. On another farm, it was retained in 12·6 per cent. of a total of 101 calvings. In the case of buffaloes, the placenta was retained in 2·85 per cent. of 41 calvings. A variety of bacteria, including pathogens, were recovered from most of the specimens of material collected from animals with retained placenta, from uterine biopsy material and uterine discharges, and also in a number of instances from normal calving material and slaughter-house material. *Brucella* was suspected to be the organism present in 23 out of 32 cases. In general, the presence of pathogenic organisms in biopsy material impeded conception.

**Contagious bovine pleuro-pneumonia**—This scheme has been in operation in Assam since 1951, with the object of studying the incidence and epizootiology of contagious bovine pleuro-pneumonia in Assam and developing suitable methods for its diagnosis and control as well as for preventing its spread to other States. The disease is still estimated to cause a total loss of more than one lakh of rupees annually in the endemic areas, even though these losses have been greatly reduced by systematic vaccination. The mass vaccination campaign in the endemic districts of Goalpara, Darrong, Sibsagar and North Lakhimpur, was intensified. Despite this, several sporadic cases of the disease appeared in these districts and some also in the adjoining districts. A number of affected animals were successfully treated with sulphamezathine, especially when administered by injection in soluble form. A fairly reliable method for

detecting cases of latent infection was developed. A quantity of freeze-dried egg-adapted vaccine received from the F.A.O. was subjected to critical trials, but it was not found to confer a high-grade immunity.

PARASITIC DISEASES

**Liver-fluke disease**—The scheme for the control of liver-fluke diseases in Mysore is in operation since June, 1953. The object of the scheme is to study the efficacy of anti-liver-fluke medication as the principal means of controlling the infestation under the conditions existing in heavily irrigated areas. Systematic dosing of the animals exposed to risk was continued at eight centres during the year, and in all 118,892 dosings were done. Among the aimals so treated, 446 were kept under special observation and their faeces examined regularly. Observations made so far would appear to indicate that it is possible to bring about considerable reduction in the incidence of infestation in endemic areas by repeated mass treatment alone.

Another scheme for the control of liver-fluke infestation in the extensive low-lying areas of Saharsa district of Bihar, was initiated in January, 1957. The staff employed under the scheme has been given necessary training, and other arrangements for undertaking the work were completed.

With the reorganisation of States, the Scheme for the control of main fluke diseases (especially nasal schistosomiasis, which was located in Dharwar district) was transferred to Mysore State. At this centre, which is located in an area where nasal schistosomiasis is prevalent, control of the infestation is sought through regular mass medication as well as destruction of the snail hosts in ponds, tanks, river beds etc. During the year under report, 853 animals affected with nasal granuloma were treated, out of which 442 were completely cured. About 50 per cent. of buffaloes in this area were also found infected with the parasite, though they did not show clinical signs of the disease, for example, in one village 21 out of the 41 buffaloes examined showed the eggs of Sabistosoma nasalis in their nasal discharge.

**Hill leeches**—A scheme for studying the biology and systematics of hill leeches in the Kumaon Hills is in operation at the University of Delhi since July, 1956, with the ultimate aim of devising suitable control measures against this menace. Heavily infested localities were detected in both Almora and Nainital districts. The land leeches collected were *Hæmadipsa zeylanica* and *H. montana*, mostly found among decaying leaves in oak forests betwen 6,000 to 8,000 ft. altitude. Leeches were observed to begin appearing along with the rains towards the end of June and to disappear generally by September, being most abundant in July and August. Their habitat during winter months remains to be discussed. Some preliminary studies on the external morphology and internal anatomy were undertaken. Instances of haematemesis caused by leeches were also observed.

ANIMAL HEALTH INFORMATION SERVICE

The Animal Health Information Service was initiated in 1947 to provide up-to-date information on the prevalence of some important diseases of live stock. Statistical bulletins are compiled every month and issued free of cost to all State Directors of Veterinary Services and Animal Husbandry, Principals of Veterinary Colleges, and heads of Central and State Research Institutes in

India. In addition, these bulletins are also being supplied to embassies and consulates of many foreign countries. So far 127 bulletins have been issued, including 12 issued during the year under report.

GENERAL DISEASE INVESTIGATION

Schemes for general disease investigation are operating in the States of Rajasthan, Bombay (Saurashtra and Kutch regions), the Punjab (Pepsu region) and Mysore. Elsewhere, these Schemes have been taken over permanently by the States.

**Rajasthan**—In Rajasthan, the observations were mainly concerned with sheep pox, 'wah' in goats, parasitic infestation and some obscure disease conditions. A severe outbreak of sheep pox, in which pustule formation was observed to be inconstant, was successfully controlled by vaccination. Clinical observations on goats affected with 'wah' revealed three main forms of the disease, viz., (*i*) ventral affection, (*ii*) eye affection and (*iii*) joint affection.

Abortions were also noted to occur in some cases. From heart blood of goats inoculated with material sent to the I.V.R.I. a pleuropneumonia organism was recovered. Histopathological examination of the mamary gland showed degeneration and desquamation of the epithelial lining of the alveoli and inflammatory exudate in the lacteals.

**Punjab**—In the Pepsu region of the Punjab, 1,052 bovines have been tested for tuberculosis infection since the inception of the scheme in May, 1954 and of these 62 have given positive or doubtful reaction. Tests conducted for *Brucella* infection on one farm and in rural areas revealed no infection on the farm (86 animals tested), but there were ten reactors out of 295 village cattle. Liver-fluke infestation was observed to be common in Kapurthala district, where a large acreage was under paddy cultivation. Chicks between the ages of 3 weeks and 12 weeks were found to be affected with coccidiosis on several occasions. The trouble was brought under control with the help of sulphamezathine and embazin, both of which were found to be equally effective. Outbreaks of spirochaetosis were observed in two private poultry units, and sulfarsenol and soamin were successfully employed for treatment as well as immunisation by the infection-cum-treatment method. Twenty-one equines were subjected to the mallein test, but none was found positive.

**Mysore**—In Mysore, where the disease investigation scheme is in operation since November, 1950, a few outbreaks of gastro-enteritis of unknown, aetiology were recorded, especially in Coorg. Some of these cases appeared to have recovered after treatment with sulphamezathine, whereas in some other cases vaccination against rinderpest appeared to have brought the outbreaks under control. Instances of obscure paralysis in cattle were reported from South Kanara and North Kanara districts. Earlier, nematode larvae were observed in histopathological examination of the spinal cord of animals dying of paralysis in other parts of the Mysore State. Ephemeral fever was reported from various parts of the State.

**Bombay**—Under the Disease Investigation Scheme located in the Saurashtra and Kutch regions of Bombay State, 400 cattle on organised farms were subjected to tuberculin test and four were found positives. Of 200 cattle sera

collected on a farm at Junagadh, none was found positive for brucellas by the plate test. Preliminary trials for treatment of contagious caprine pleuropneumonia with N.A.B. gave encouraging results.

Riboflavin deficiency, manifested by curly toes and other clinical signs, was encountered on a poultry farm and successfully overcome by the inclusion of yeast and vitamin B 12 in the feed. On another farm, deficiency of vitamin A was encountered, accompanied by the usual clinical signs, reduction in egg yield and decrease in yolk pigment. It was successfully treated by the inclusion of cod-liver oil in the feed. Schistosomiasis was responsible for an outbreak of diarrhoea and deaths among sheep. The other diseases encountered and investigated were fowl spirochaetosis, liver-flue infestation in buffaloes, coccidiosis in chicks, horn cancer, and filarial haemorrhages in cattle. *Ascaridia galli* infestation was found to be very common in poultry. Some cattle were found to be affected with a condition closely resembling the hump sore of north-eastern India.

DISEASES OF SHEEP AND GOATS

Schemes for the investigation of sheep and goat diseases were in operation in Uttar Pradesh and Andhra Pradesh.

In Uttar Pradesh, the Mukteswar sheep pox vaccine was found safe for vaccinating the imported Australian sheep and their graded progeny, but the immunity was observed to wane after 12 months. Tests conducted revealed that there was no immunological relationship between sheep pox, sheep dermatitis, and contagious pustular dermatitis. Pneumonia was observed to be a frequent cause of deaths among imported as well as indigenous sheep.

A variety of pathogenic organisms were found associated with the disease. Heavy infestation with *Cymbiforma* indica was suspected to be the cause of deaths among sheep in Almora district. Immature amphistomiasis was responsible for heavy losses among sheep in Allahabad and Varanasi districts. From material forwarded to the I.V.R.I. from sheep suspected to have died of enterotoxaemia, *Clostridium welchii*, Types D and A, were isolated. Cerebro-spinal nematodias was suspected to be the cause of paralysis in some sheep and goats. Six Polwarth lambs were found to be infected with *B. motasi* and were treated with babesan and acaprin.

In Andhra Pradesh, diseases of sheep and goats caused by parasitic infestations and certain other diseases like "Circling" disease, abortions and contagious pustular dermatitis were investigated. A variety of worm infestations were found to be responsible for much of the diarrhoea in sheep and goats. Abortions were observed in a few sheep, but these were found negative for Brucella infection on agglutination test.

**Bearing of Nutrition on Helminthic Infestation**—This scheme has been in operation at the Indian Veterinary Research Institute since April, 1955, with the object of investigating the effects of nutritional deficiencies on the resistance of sheep to parasitic infestation. Suitable mixtures deficient in Vitamin A, protein, calcium and phosphorus either singly or in combination were computed; groups of lambs were fed on these; their blood analysis was undertaken; and regular fecal examinations were done as a preliminary to their experimental infection with different parasites.

**Diseases of poultry**—Observations made in Poona district (Bombay), where a scheme for mass immunisation of village poultry against Ranikhet disease is operating since 1954, generally indicated good results, though there were stray instances of breakdown of immunity in some vaccinated birds, especially on challenge 12 months after vaccination.

In a scheme for the control of coccidiosis in poultry, operating at the Indian Veterinary Research Institute since February, 1955, the existence in India of *Eimeria necatrix* and *E. burnetti* was confirmed. For studying the efficacy of certain anticoccidial drugs, such as sulphaquinoxaline, sulphamezathine and nitrofurazone, a number of chicks were reared coccidia-free and subsequently infected with *E. tenella*. Sulphamezathine was better than sulphaquinoxaline, but the latter was better as a prophylatic agent. Both the drugs were found to be better than nitrofurazone.

Under the scheme for the investigation of poultry diseases in Andhra State, vaccination of day-old chicks with pigeon pox vaccine successfully protected the birds against fowl pox, which was observed to be prevalent in the State in all the three forms, viz. ocular, oral, and cutaneous. Avian leucosis complex was prevalent on organised farms, especially in White Leghorn birds.

In a scheme for studying the use of a combined vaccine for Ranikhet disease and fowl pox, a mixed vaccine was found to set up the same type of immunity against both the diseases as that by the two vaccines individually in six weeks-old chicks. The chicks embryo-adapted strain of R.D. virus was found to grow well on the chorio-allantoic membrane of duck eggs, and this virus on inoculation in 4 to 5 week old chicks did not produce a generalised reaction, nor did it spread to healthy in-contact chicks.

## DAIRYING

**Survey of bacteriological quality of milk produced in Kaira District—Anand**—The scheme was started in September, 1957, with a view to evolve suitable measures for improving the keeping quality of milk and milk products. The effects of atmospheric temperature and humidity during winter, summer and monsoon on the bacteriological quality of raw milk collected from various societies were studied. The average temperatures were 70·94°, 86·59° and 84·85°F and the humidity levels were 56·3, 45·62 and 79·09 per cent. during the respective seasons. The average bacterial count varied from 7 to 38 millions per ml. during summer, 7 to 50 million per ml. during monsoon and from 2 to 10 million during winter. The methylene blue reduction time varied from 1 to 2 hours during summer and monsoon and 2 to 4 hours during winter respectively, showing that the milk was of poor bacteriological quality. In addition to the above, 157 samples of bulk raw milk, 493 samples of laboratory pasteurised milk and 261 samples of Union pasteurised milk were examined. The milk pasteurised at the Union Dairy was found to be of good quality as judged by the low bacterial count, which varied from 10,000 to 33,000 bacteria per ml. during different seasons.

The preliminary work on bacteriological analysis of milk products manufactured by the Union viz., milk powder, butter, etc. was also carried out. The result pertaining to this item will be reported next year when enough data have been collected.

**Scheme for development and standardization of methods for detecting adulteration and estimating major constituents of milk at Hoshiarpur, Punjab**—In all, 1,793 samples of raw milk were collected.

The Scheme was started on April 1, 1955, and was due to terminate on March 31, 1956. It has been extended for a further period of two years. The object of the Scheme is to examine the physico-chemical properties of milk with a view to find out certain characteristics which may be helpful in evolving and standardizing some simple methods for detecting adulteration and for estimating the major constituents of milk.

Work was conducted on measuring interfacial tension of milk and using it as a measure for detecting adulteration with water. It was observed that with P. cymene the interfacial tension could be accurately determined. There was no change in interfacial tension up to 10 hours from the time of milking. The removal of fat did not affect the interfacial tension. Proportionate increase in interfacial tension of milk with the addition of water took place in both cows and buffaloes milk, even when the adulterant was 5 to 7 per cent.

Aqueous ammonia, when added to milk independent of ammonium solution concentration, increased its viscosity to an appreciable extent. The viscosity of the mixture increased proportionately but was constant on keeping for 5 hours or shaking for about an hour.

Cow's or buffalo's milk to which goat's milk was added showed the presence of two peaks in its fat globule size distribution curve; while cow's and buffalo's milk when added together showed only one peak. The measurement of size of fat globules was found useful in detecting the presence of goat milk.

The electrical conductivity of goat's milk, was found to be greater than that of cow's or buffalo's milk. So the adulteration of cow's or buffalo's milk with goat's milk, even in moderate quantity, can be detected by the measurement of electrical conductivity.

The freezing point of pure milk of different animals was found to be constant, but the addition of water, even in small quantity, altered its freezing point so that adulteration with water can be easily detected.

**Investigation of the Possibilities of using milking Cows of Hariana breed for work at the I.V.R.I., Izatnagar**—During the year, six work and seven no-work cows completed their lactation. A marked drop in the milk yield was observed in the case of work cows compared to the non-work group.

The average milk yields of the cows which have completed the third experimental lactation were 1,412 lb. and 2,266 lb. for work and no-work groups respectively. Further, a cow which yielded 3,577 lb. in the last lactation, yielded 69·3 lb. in the current year as it suffered from mastitis. The butter fat average are 65·17 lb. and 112·5 lb. for work and no work groups respectively, the lower butter fat production could be attributed to lower milk yield.

In all, 9 work-and 9 no-work cows conceived with an average of 4·3 and 1·9 inseminations respectively. This difference is due to the presence of 2 cows in the work group which, among themselves, required 15 inseminations out of 39 received by all the 9 cows in that group.

Work is being continued and no definite conclusion can be drawn at this stage.

**Studies on the preparation of dairy Sanitizers (N.D.R.I., Bangalore)**—The scheme commenced in June, 1955, with a view to test the corporative, detergent and germicidal efficiency of different cleaning materials and chemicals commonly available. During the year most of the work was done to study various compounds and it was found that patented products and quaternary ammonium compounds like hyamine pyridinium bromide and cotyl pyridinium bromide are quite effective against all species of bacteria, giving more than 99·999 per cent. destruction within 5 minutes. Compounds like Triton X-100 and Solvey Nitron were less effective especially against coliform and spore-forming bacteria. The former group is considered suitable for incorporation into the cleaning mixtures. Studies were also carried out in compounding of cleaning and sanitizing mixtures from different cleaning materials. The sanitizing efficiency of ash could be considerably improved when mixed with small amounts of phosphates, washing soda and bacteriacidal compounds like hyamine and pyridinium bromide. Similar results are obtained with Reh. In areas like U.P. and the Punjab where Reh is available in plenty, it is possible to substitude it for ash. Such mixtures are considered quite promising for use under village conditions *viz.* individual milk producer or milk producer societies and milk collection centres.

Sanitizing efficiency of clearing mixtures obtained from some firms showed good results, but molaces, an I.C.I. product although showing good sanitizing efficiency was found to be irritating to human hands.

Regarding the occurrence of stale odour in cleaned cans, investigations with open, partly open and inverted sterilised cans, which were kept overnight showed that the stale odour was experienced in 50 per cent. and 25 per cent. respectively only in the case of latter two positions. Among the cans not properly cleaned a mild stale odour was found even when kept open, which shows that sterilisation after proper cleaning considerably reduces the development of stale odour, even if the cans are kept closed. Further trials are in progress.

**Utilisation of by-products of Indian Dairy Industry (N.D.R.I., Bangalore)**—The object of the Scheme is to evolve suitable techniques for the utilisation of by-products in the ghee and butter industries. Skim-milk and butter-milk are the major by-products upon which the investigations were carried out.

For storing skimmed milk and butter-milk, stainless steel containers are the best ones followed by newly tinned cans and old tinned cans. Glazed mud pots and unglazed mud pots were found unsuitable for storage.

The best process to increase the keeping quality was observed to be the heating of skimmed milk to boiling temperature followed by immediately cooling it to room temperature and storage under similar conditions.

To manufacture dried products from skimmed milk and butter-milk under village conditions, it was found that the only feasible method is concentration and desiccation of the raw by-product in an open pan till a pat is formed. The pat is broken, powdered and sieved. The powder may be further dried in sun or chamber. The dried skimmed milk and butter-milk could be beneficially incorporated upto 20 and 5 per cent. respectively in dough for (Wheat) chapaties. For storage of skim milk powder and *desi* butter-milk powder cardboard cartons were found to be most desirable containers

Good quality casein could be obtained from spoilt milk by alkali treatment method and from creamery or *desi* butter-milk by double alkali treatment-cum-mechanical separation method.

**Studies on pasteurization of Milk**—More than 460 samples of raw and pasteurised milk were collected during the monsoon, winter and summer from two private milk distribution centres and two organized Dairy Farms. The samples were analysed for bacteriological quality. It was observed that laboratory and commercial pasteurisation considerably reduced the bacterial count. Samples of raw milk were heat-treated at 63·5°C for 30 minutes under laboratory conditions and examined for their keeping quality. It was observed that the methylene blue reduction time of raw milk sample from one of the centres had an average of about 3¼ hours. The same samples after laboratory pasteurisation had a keeping quality period of 16 hours. It was further noticed that the count of raw milk samples was much higher during summer than that observed during either winter or monsoon. It was observed that increase in temperature and heat treatment reduced the bacterial count progressively. Further, the batch pasteurisation temperature namely 63°C for 30 minutes was more efficient in destroying bacterial cells than H.T.S.T. pasteurisation at 72·5°C for 16 seconds when milk with low bacterial counts was pasteurised under laboratory conditions. The Coliform group of organism were destroyed by heat treatment (62·8°C) within 20 minutes even when the initial count was very high. *Aerobacter œrogenes* was less heat resistant than *Escherichia coli*.

Studies on the heat resistance of pure cultures of bacteria at different temperatures and holding periods have also been carried out. The effect of pre-incubation of pure culture on heat treatment and subsequent keeping quality have been studied. The influence of normal microflora on the heat resistance of pure culture suspended in whole milk have also been investigated.

### ANIMAL NUTRITION

**Trace elements scheme, I.V.R.I.**—Scheme for studying the influence on trace elements on the health and productive capacity of livestock in India continued to function at I.V.R.I. This scheme was initiated in the year 1952 with the object of finding out whether trace element deficiency occurs in livestock in India and if so where.

During the year under report 67 samples were analysed for their copper contents. It was observed that in dry roughages like hay and straw, the content of copper ranged from 2·55 p.p.m. in paddy straw from the Khawardha region of Madhya Pradesh to 6·5 p.p.m. in *Jowar* straw from Haldwani; 75 per cent. of these had a value lower than 5 p.p.m. Green non-leguminous feeds had values ranging from 5·25 to 7·65 p.p.m. while leguminous feeds gave copper contents between 8·21 p.p.m. to 15·92 p.p.m. Tree leaves had values ranging between 3·92 p.p.m. at Kukhteswar to 11·50 p.p.m. in *bhekar* leaves from Jammu and Kashmir. Concentrates had values ranging from 1·41 p.p.m. in gram husk from Mongrol to 19·03 p.p.m. in groundnut cake from Morvi. A sample of rock salt from Mongrol was also examined. This had a copper content of 30·73 p.p.m. The copper intake per day in mg for cattle weighing 700 to 800 lb. in different farms was calculated.

It was observed that the intake of copper was definitely below 6·3 p.p.m. in dry cows and 10 p.p.m. in milch cows per 100 lb. body weight. The level of intake though just sufficient for dry cows at Morvi and Mukhteswar, is definitely low for the milch cows at these places. In all the places where copper intake is low, the haemoglobin content of animals was also found to be sub-normal. Intake of copper for sheep in the State of Jammu and Kashmir was found to be adequate.

Sixty seven samples of feeds from hilly and sub-mountainous regions of Uttar Pradesh and from Saurashtra, Madhya Pradesh and Jammu and Kashmir farms were analysed for their manganese contents. Among dry roughages examined the least value *viz.* 48·74 p.p.m. on dry matter basis was found in the wheat *bhusa* sample from Haldwani and the highest, *i.e.* 293·6 p.p.m. on dry matter basis in the paddy straw sample from Khawardha region. In all the concentrates, cotton seed had the least content ranging from 12·44 to 28·60 p.p.m., while wheat bran had the highest content of this mineral ranging from 78·09 p.p.m. to 195·37 p.p.m. Some types of feed from different localities showed wide variations in their manganese contents. The daily requirement of manganese except at Mongrol was found to be quite sufficient for all the livestock.

Cobalt content of feeds of six farms was determined. The values ranged from 0·06 p.p.m. in the paddy straw from Patna to 1·43 p.p.m. in the concentrates mixture from the Telinkhudi farm, Nagpur. The intake of cobalt in mg. per day per animal was also estimated.

Work was initiated to find out whether excess of molybdenum played any part in the aggravation of copper deficiency symptoms or inducing deficiency even in places where copper intakes were usually adequate. A method for the estimation of molybdenum in feeds has been worked out. Twenty-five feed samples from different parts of the country were examined and the values ranged from zero in guinea grass and *jawar* from Hosur to 1·78 p.p.m. in the concentrate mixture from Bellari and Bombay. Work so far carried out has indicated that this element is not present in excess at any place examined so far. Studies on haemoglobin content of blood of animals was continued in different forms for the State of Saurashtra and Madhya Pradesh. At both these places buffalo blood was found to be lower in haemoglobin content than cattle and was below the normal values. Work was also continued on the copper contents of blood and liver of the domestic animals.

Thyroid glands were collected from the slaughter houses in the States of Madhya Pradesh and Saurashtra for finding out existence of goitre. Specimens thus collected were also put to histopathological studies.

**Regional Animal Nutrition Centres**—The Council had established Regional Animal Nutrition Stations to study problems of animal nutrition pertaining to each region. Till 1954 three regional stations were established for the Eastern, Western and Southern regions at Harringhatta, Anand and Bangalore respectively. Scheme for the establishment of the Northern Regional Station in the Punjab has also been sanctioned. Proposal is under consideration for setting up of another Station to cater to the needs of coastal region.

Eastern Regional Centre, Harringhatta—A comprehensive survey carried out within the State in different seasons of the year indicated that the intake of digestible proteins and starch equivalent were considerably below the accepted feeding standard. It was, however, contended that these animals also received some nutrients from stray-grazing. Rations usually fed to cattle in the State of Bengal mainly consisted of paddy straw and a little of mustard cake and wheat bran. Feeding practices in the State of Orissa were not very much different. However, typical ration in Orissa consisted of paddy straw, rice bran and *kulthi*. The bullocks of Orissa were found to be better in physique than the bullocks of West Bengal. Average weight of bullocks in West Bengal was found to be 434±81 lb. and that of cow; 306±52 lb. The corresponding figures in Orissa were 438±104 and 320±59 lb. On an average cows give 340±204 lb. of milk in the State of West Bengal while in Orissa yield was even lower. Other data of cows i.e. lactation and inter-calving period, age at first calving etc. were also recorded and it was observed that performances of the local non-descript cattle were very low. Similarly the performance of the bullocks was also of a low order. Seasonal variations in the composition of the concentrates and roughages were found to be negligible. Some variations were, however, noticed in case of tree leaves. No significant seasonal variations were observed in the same variety of straw (Aman).

Composition of three varieties of staw i.e. Aman, Aus and Bore, differs significantly in respect to protein, oxalic acid and calcium. Tree leaves were in general, found to be good sources of protein, calcium and copper but were found to be comparatively poor sources of phosphorus. A creeper, Sunnai was found to be the richest source of copper. The results of some 34 types of fodder and feed stuffs were recorded in detail. Significant variations were found to occur in the composition of some feed stuffs obtained from two States, i.e. West Bengal and Orissa. In confirmation with the data on D.P. and S.E. intakes, some indications on the occurrence of microcytic anaemia were observed in West Bengal bullocks. Microcytic anaemia was also found to occur in castrated goats. Close positive correlation between the inorganic phosphorus and phosphates was demonstrated in goats and cattle including buffaloes. Significant species differences in inorganic phosphorus and phosphates content were also noticed. Blood copper was found to be unrelated with liver copper. The results of liver copper also showed that the copper content of the male liver was greater than the female liver. This result was at variance with the results of liver vitamin A, which was found to be maximum in the female and minimum in the male goat liver. A notable feature in the results of liver composition was the occurrence of high lipoid content during the rainy season which is attributed to general under-nutrition. Vitamin A ester content of the female and castrated goat blood was found to be significantly lower in the monsoon season than in the summer or winter seasons. This indicates a lower intake of carotene during the monsoon period.

Western Regional Centre, Anand—The Western Animal Nutrition Research Station, Anand was set up in the year 1952. The centre has been handling all the problems prevailing in the States of Bombay, Rajasthan, the Punjab and parts of Madhya Pradesh and Uttar Pradesh and in the erstwhile states of Saurashtra, Cutch and Madhya Bharat.

In the Hissar area, along with the survey work, samples of concentrates and fodders of *rabi* season were collected. Blood samples were also collected. In Banni area 32 enclosures were laid, from which grasses were harvested at different intervals in order to study the effect on yield and composition. Digestibility trials on fodders and concentrates were also carried out. Hamatological constituents of blood taken from animals brought to veterinary hospitals were estimated.

In the Hissar area samples of common *rabi* fodders like wheat, barley, oat, berseem, lucerne, wheat chaff and gram *bhusa* were studied. The stagewise composition of cereal fodders indicated a decreasing trend in crude protein and minerals. In all the fodders the crude protein content in the young stage was as high as 15 to 18 per cent. and it was reduced to 3 to 5 per cent. in the third monthly cut. Oat fodder was slightly superior to wheat and barley. Lucerne and berseem were similar in composition except that the former was slightly more fibrous than the latter. Both of them were about four times richer in calcium than cereal fodders. Generally, the same fodder from different villages was not found to vary significantly. Wheat chaff, containing about 5 per cent. crude protein, was richer in all respects than wheat straw from Anand area. Gram *bhusa* was found to contain only 3·9 per cent. crude protein. Composition of leaves of *babul*, neem and *shisham* revealed that *neem* leaves having 16 per cent. crude protein and only 17 per cent. crude fibre were most nutritious.

Among concentrates, *bajra*, barley and wheat grains were found to be uniform in composition having about 11 per cent. crude protein and 80 per cent. N.F.E. *Sarson* cake, containing about 30 per cent., crude protein, is richer than *sarsoan* and cotton seeds. *Sarsoan* seeds contain 37 per cent. ether extract, which was more than twice the amount present in cotton seeds. Among grams, *sugar* and *methi* gram which was available in abundance, was highest in N.F.E. (65 per cent.) and lowest in crude protein (20 per cent).

A study of animal blood from Hissar area revealed that the Hb per cent. of the blood of buffalo calves (10·6) was higher than that in the blood of bullocks (9·7) from Hissar farm and from villages. A survey of deficiency diseases in Hissar area did not reveal any outstanding nutritional deficiency.

From 32 enclosures laid out in Banni area, 192 samples of pasture grasses harvested at different intervals were collected and 96 were analysed. The data regarding the yields of pasture grasses obtained by three different methods of cutting revealed that the highest yield of 5,592 lb. per acre (on fresh basis) was obtained when the grass was harvested three times at monthly intervals. The yields vary significantly from village to village and from enclosure to enclosure.

A digestibility trial was carried out on a concentrate mixture containing 20 per cent. G.N. cake, 20 per cent. cotton seeds, 20 per cent. maize bran, 16 per cent. *tur chuni*, 15 per cent. *guar* and 10 per cent. *bajra* husks. The mixture provides 18·39 lb. D.P. and 79·9 lb. of T.D.N. per 100 lb. of dry matter. The mixture was cheaper by 30 to 40 per cent. and better balanced than *bajra* grains, *guar* seeds and cotton seeds which were commonly used. The hay of mixed grasses available in the local market supplied 57·01 lb. of T.D.N. per 100 lb. of dry matter but no protein. The digestibility coefficients of all the nutrients in *neem* leaves were more than 80 per cent. and consequently, the

T.D.N. was found to be as high as 79·01 lb. per 100 lb. of dry matter. The D.P. provided by *neem* leaves (9·96 lb. per 100 lb. of dry matter) was also fairly high. Moreover, the balances for nitrogen, calcium and phosphorus were also positive. Mangolds supply 1,050 lb. D.P. and 71·97 lb. T.D.N. per 100 lb. of dry matter. The balances for protein, calcium and phosphorus were all positive. However the dry matter in mangolds was as low as 8 per cent.

Analysis of blood of animals brought to veterinary hospitals revealed that the values for Hb. and R.B.C. in the case of buffaloes were higher than in the case of bullocks. Percentage of lymphocytes in the blood of bullocks was higher than in that of buffaloes while the average value for polymorphs was lower.

Extension work was carried out in Banni and Hissar area along with nutritional survey. Advantages of scientific feeding of animals were explained to cultivators and cattle owners in agricultural and cattle shows.

Southern Animal Nutrition Research Centre, Bangalore—During the year under report a comprehensive animal nutritional survey was carried out in the tracts of Kangayam, Tripura, and Karimnagar. In the Kangayam tract the common pasture grass was found to be Kolukattai (*Cenchrus ciliaris*). The protein content of the grass ranged from 5 to 12 per cent. Green plants of Dua gram or Moth (*Phasodus aconitifolisu*) containing 18 to 20 per cent. protein was also fed to the cattle during monsoon. The monsoon grasses were collected and analysed. Their protein content ranged from 3·2 to 9·4 per cent. The protein content in various dry fodders ranged from 2·38 to 4·87 per cent. The concentrates which were fed to the cattle varied in their chemical composition. Average weights of the cows in the area ranged from 413 to 595 pounds; bullocks, 456 to 1,040 lb.; buffaloes, 501 to 615 lb.; and bulls, 523 to 1,423 lb. In Tripura area the grasses were found not to be so nutritious as in the Kangayam tract. The protein content of the grasses of the area ranged from 2·6 to 5·5 per cent. and that of fodders from 2·4 to 4·1 per cent. The concentrates of the area were found to vary in their chemical composition. Cotton seed feeding was prevalent in the area. Average weights of cows ranged from 336 to 719 lb.; bullocks, from 397 to 1,067 lb.; and buffaloes, from 425 to 980 lb. In Karimnagar the survey was carried out in the *rabi* season. The soil was found to be sandy loam, red and black in colour. The cows were generally not milked and were not fed with any concentrates or green fodder. The average milk yield was very low. The haemoglobin content in the blood of buffaloes, cows and calves was found to be 7·0 to 11·0, 5·5 to 8·0 and 6·0 to 8·0 respectively.

**Degeneration of Cattle in Humid Climates**—The scheme to investigate the causes of degeneration of cattle in humid climates was initiated in the year 1954 at the I.V.R.I. with field units at Calcutta and Hissar. The object of the scheme is to investigate the causes of inability of cattle to manifest their characteristic performance if they were transported from their home tract, especially to a humid tropical environment.

Work initiated in the previous years was continued during the year under report on the basis of observations made over a period of 100 weeks and it

revealed that there was no significant (5 per cent. level) difference in growth rates between the feed groups of both the Hariana and Bengal breeds, whereas it was highly significant between the breeds. It was observed last year that there was no appreciable difference in rectal temperature and pulse rate per minute at rest between the different groups in Calcutta and control animals at Hissar. These findings were confirmed this year. The respiration rate per minute, at rest, of Bengal animals was, however, found to be somewhat higher than Hariana animals at Calcutta. The control animals at Hissar registered the highest rate. No such differences were apparent between the feed groups. Work regarding heat tolerance index is in progress. 9 N.P. Findings of the previous year regarding actual feed intake per day per 100 lb. body weight were found to be higher in Bengal animals. Animals at Hissar consumed more feed than Hariana. Rate of consumption of water was higher in the case of Bengal animals than in Hariana animals. Animals on Bengal fed diet, consumed comparatively more water than the Punjab feed groups. In Calcutta, Hariana animals on Punjab diet had higher haemoglobin concentration than the remaining three groups at Calcutta. W.B.C. count did not show any appreciable differences between the breed and diet groups. At Hissar the control animals showed highest values in haemoglobin of R.B.C.S. The count in these animals, however, did not show any appreciable difference in comparison to Calcutta animals. The level of protein, NPN, inorganic phosphorus in blood serum was highest in Hariana heifers at Hissar and lowest in Bengal heifers at Calcutta. At Calcutta the Hariana heifers on the Punjab diet had higher level of protein, NPN, calcium and inorganic phosphorus than the Hariana heifers on Bengal diet. The latter had a higher level of protein, NPN, calcium and inorganic phosphorus than Bengal heifers on Bengal diet. Between the breeds, Hariana heifers had a higher level of protein, NPN, calcium and inorganic phosphorus than Bengal heifers. The control groups, animals in Hissar continued to be free from the worms infestation. In Calcutta faecal examination did not reveal any difference between the breeds or between the diet groups. On the whole, degree of infection was less than the previous year. This may either be due to advance in age of the experimental animals or frequent deworming carried out in previous year. Feed and water analysis was done as in the previous year. Photographic records of the experimental animals were maintained 9 N.P. Data pertaining to studies on reproduction was recorded and it was observed that the animals at Calcutta of both the breeds on the Punjab diet fared better in their reproduction record than the Hariana and Bengal animals on Bengal diet. Metabolic trials in different seasons of the year were conducted and it was observed that on an average, between the two breeds, Hariana animals had shown higher digestibility for dry matter, crude protein, ether extract and total carbohydrates in comparison to Bengal animals. The balances for nitrogen, calcium and phosphorus were also higher for Hariana animals. Animals of both the breeds on the Punjab diet had on an average higher digestion co-efficients for crude protein. Balance of nitrogen, calcium and phosphorus was also higher in these animals. Milk yield and fat percentage records are being maintained. There were four calvings at Hissar and 10 at Calcutta among the experimental animals. Cases of congenital cerebral ataxia were also met with. Causes of this disease are being investigated.

**Utilisation of Waste Products as Cattle Feed, Orissa**—The scheme for the utilisation of waste products as cattle feed in Orissa was initiated in December, 1954 with the object of studying the palatability, digestibility and physiological response of the animals fed on such waste products as were already examined and found suitable in respect of their nutritive value etc. and to find out the economics of feeding such products.

Work already initiated in four sub-centres, established in the previous years' was continued. Tamarind seed and *mahuwa* flower feeding experiments were continued this year also and it was observed that at the Keonjhar centre, the buffalo cows in group A which received 10 per cent. tamarind seed mixture produced 3,428 lb. of milk, group B on 20 per cent. tamarind seed produced 3,607 lb. of milk and group C on control ration yielded 2,408 lb. of milk. In the case of cows the milk yield in group A was 1,310 lb., in group B 1,182 lb. and in group C on control ration, milk yield was 1,247 lb. In buffalo cows the total butter fat content of milk produced was 210·5 lb. in group A. 243·0 lb. in group B and 193·0 lb. in group C. In cows the corresponding figures were 55·7 lb., 55·5 lb. and 58·7 lb. respectively for groups A, B & C. Cost of production for one lb. of milk and one lb. of butter was also worked out. Experiments were also done on young stock and cost per maund increase of body weight was worked out. Experiments were also initiated on feeding cassiatora seeds and it was observed that in the beginning for about one month the animals did not relish the ration containing this ingredient but later on they got used to it and consumed their ration normally. Animals were fed at 10 per cent. level and 20 per cent. level and a third group was kept as control. It was observed that animals of first and second group produced 10·7 and 9·7 per cent. less milk in comparison to the group C fed on control ration. Cost and Production of butter fat and milk per lb. was also calculated. Animals in the control group produced the highest amount of butter fat. Animals in group A yielded more butter than the animals on group B. Animals in group B produced milk at the minimum cost, followed by control group and group A. Studies were also made on gains in body weight in the growing animals. Maximum gain in body weight was in the control group and least in group B. The results so far achieved are encouraging.

**Further Work on Paddy Straw—I.V.R.I.**—Scheme for further work on paddy straw was initiated at the I.V.R.I. in the year 1954 with the object of studying the disadvantages of paddy straw as a cattle feed and to development methods for the improvement of paddy straw rations.

During the year under report, studies were made to find out the factors responsible for the poor quality of paddy straw as roughage with a view to evaluate the effects of water washing of paddy straw and of supplementation of rations based on untreated or water washed paddy straw with calcium salts or a trace mineral mixture. It was observed that water washing resulted in appreciable reduction in the content of crude fat, oxalates, phosphorus, magnesium and potassium. There was an increase in the content of calcium. It was further observed that the calcium balance was negative on all the rations so far tested. Supplementation of rations with moderate doses of calcium salts or a trace mineral mixture was also without effect. Phosphorus and magnesium balances were comparatively lower under washed straw rations. The digestion co-efficient of total carbohydrates in straw tended to be higher on washed

straw rations. The supplements tested (calcium carbonate, calcium chloride and trace mineral mixture) did not seem to exert any appreciable influence on the digestion of nutrients. The experiments are being continued, so as to assess the long term effects of the test rations.

**Urea as a Protein Substitute—I.V.R.I.**—The scheme to study the value of Urea as a protein substitute in the ration of cows and buffaloes for growth and milk production continued to function at the I.V.R.I. The object of the scheme is to study how far the knowledge gained abroad on the feeding of urea to ruminants could be applied with advantage to meeting the protein requirements of Indian cattle. During the year under report, 24 calves aged 8 to 14 months were selected and divided into four groups of six each. The first group was kept as control. The second, third and fourth group received urea in their rations replacing 10, 20 & 30 per cent. of the digestible crude proteins. The above dietetic regime was carried out for about a year and the data thus collected were statistically examined. After a period of about nine months metabolic trials were conducted. There were practically no differences in the digestibility co-efficients of the proximate principles except for crude fibre. The digestibility co-efficient of the crude fibre of the ration for the control group was slightly higher than that of other groups. The percentage retention of nitrogen was higher in the control group than in the other. The feeding of ureas had no effect on calcium and phosphorus retention. Physiological studies on pulse rate, temperature and respiration rate were made at fortnightly intervals. It appears from the data that inclusion of urea in the ration of growing calves does not affect these physiological characters.

## HIDES AND SKINS

**Manufacture of fat liquors from indigenous raw materials**—Reports received on the commercial use of the fat liquor manufactured last year from sulphated pongam oil indicated that this product was as satisfactory as the imported one, like the cremols. This fat liquor is now being used to a considerable extent at the Central Leather Research Institute, in preference to imported fat liquors and it was also supplied to certain other firms to the extent of 20 to 30 cwt. During the year under report, investigations regarding the characteristics of indigenous oils were confined to the yellow oleander seed oil and corail seed oil. Applications were filed to patent the methods of manufacture of fat liquors from pongam oil and fish oil, and it was reported that at least four firms were interested in taking up the process for commercial exploitation. The fat liquors developed so far are suitable for shoe-upper leather. Preparation for fat liquors suitable for other types of leather is under contemplation.

**Improvement of shoe upper and industrial leather**—During the year under report, further work was undertaken for the preparation and study of chrome liquors from sodium dichromate, the study of the nature and extent of the complexes formed, and conducting tanning tests with the different liquors prepared and containing varying amounts of the complexes. The cationic, anionic and nonionic complexes were separated by paper electro-phoresis. The variation of oleation with time was studied, as also the fixation of chrome from the liquors prepared *vis a p*H of tanning and variation of basicity and oleation by ageing.

**Manufacture of leather boards from tannery waste materials**—During the year under report, different kind of leather board suitable for different purposes were made. Some processes were worked out to make satisfactory boards of different stiffness and pliability on a laboratory scale and the results obtained in the pilot plant were also very satisfactory. Work was taken up to develop a method of processing for bringing all types of leather wastes to a uniform condition before starting the manufacture of leather boards, in order to get uniform results. Further, since rubber latex was observed to change its properties on storage, work was also taken up to assess the quality of the latex used.

**Manufacture of chrome retan leather** - An available Indian extract, viz., Cutch Extract No. 2 was found suitable for retanning to improve the quality of inferior hides. For the manufacture of shoe upper, the optimum percentage of tanning was determined, and it was found that the fixation of tanning varied directly with the concentration of pure tannin in the liquor used; the actual tan: non-tan ratio was found to have no effect on the percentage of tannin fixed. The optimum duration of tanning was also determined. Retannage experiments were carried out with whole hides, and Cutch Extract No. 2 was found to be even superior to foreign extracts for the manufacture of shoe upper leathers suitable for both civilian and defence purposes. As a result of the investigations conducted under the scheme, it has become possible to manufacture good quality leather from the inferior fallen hides by using indigenous tanning materials.

### CATTLE STERILITY

The co-ordinated scheme on cattle sterility financed by the Council continued to function in all the seven centres sanctioned since 1954. The object of the Scheme is to improve the teaching of animal gynæcology and obstetrics at the veterinary colleges and to conduct investigations on problems relating to infertility.

**I.V.R.I.**—At the I.V.R.I. centre studies were undertaken on animals of the Institute herd as well as a few other neighbouring herds. During the year under report, 8,000 genital organs from buffaloes slaughtered in the municipal abattoir were examined, and in these the incidence of matritis was found to be as high as 24 per cent. Preliminary investigations on intra-uterine treatment with antibiotics and sulpha drugs in repeat breeders, were undertaken with encouraging results.

**Uttar Pradesh (Mathura)**—At Mathura, the average age at first fertile heat in Hariana heifers was 3 years and 6 months; and 98 per cent. of the cows came on heat in the morning hours. In buffaloes, the average age at first calving was 4 years and 7 months. It was observed that buffaloes in U.P. generally calved during the period from September to February and came in heat about 24 days after pasturition. In 75 per cent. of the buffaloes the inter-calving period was 11 to 16 months. Inflammatory processes due to infection were much more common in organised farms than in village animals. In the villages, an œstrus conditions were found to be common, especially in young animals. Management and nutrition were believed to exert significant influence on the sex behaviour of the animals.

**West Bengal**—In West Bengal, 237 œstrus cycles in cattle and 106 in buffaloes were followed, as also 161 calvings in cattle and 65 in buffaloes. Genitalia from 500 bovines were collected from the slaughter-house; salpingitis, cervicitis and vaginitis were detected in 35, 40 and 33 of these, respectively; in 36, the ovaries were found to be non-functional; matritis was detected in 92; and 24 were in early stages of pregnancy. Last year, *Trichomonas foetus* infection was detected for the first time in India in a cow. During the year under report, eight more cases of this infection were encountered.

**Madras**—In Madras, investigations were conducted on 1,281 animals brought to the veterinary college hospital for gynæcological attention and this material was used for imparting practical training to the students and for making other observations. Of these, 145 required treatment for retention of placenta. The incidence of sub-functional genitalia, sub-functional ovaries, and vaginitis was 6·73, 15·1 and 5·77 per cent. respectively. A group of 25 Sindhi cows at the Hosur Cattle Farm, was kept under observation for studies on reproductive physiology. A variety of organisms were isolated from 77 vaginal and cervical swasbs of slaughtered animals.

**Bombay**—In Bombay, observations on the Physiology and Pathology of reproduction were made on six herds. Sub-functional ovaries were detected in 24 cows and six buffaloes; and cystic degeneration of ovaries in 13 cows and one buffalo. Inflammatory conditions of the genitalia were observed in 64 cows and 35 buffaloes. In all, of five aborting cows and one aborting buffalo, the fœtal membranes were retained. In one herd, copper deficiency was suspected to be the principal cause of reduced fertility. Treatment with copper and cobalt helped establishment of conception, in most cases, within a few months. From slaughter-houses, 364 genitalia were collected and studied. In 59 of these, sub-functional ovaries were detected, and cystic degeneration was noticed in 74; inflammatory processes in the reproductive tract being present in 66. Material collected from one infertile heifer yielded *Vibrio foetus* on culture and blood sera from some animal of the same locality were positive in agglutination reaction for that organism. Delayed maturity in heifers and hormonal deficiences were suspected to be the major factors responsible for sub-fertility in a number of herds.

**Bihar**—In Bihar, observations were made on six herds of cattle and buffaloes. There were seven cases of persistent hymen and one case of ovarian hypoplasia in Hariana cattle, an œstrus ovaries in 20 Hariana and one Tharparkar cows and silent œstrus in 20 Hariana and 3 Tharparkar cows. Observations made on 635 animals in the college clinic, revealed granular vaginitis 35 in heifers and 86 cows; cervicitis in 24 heifers, 76 cows, four buffalo-heifers and two buffalo-cows and cystic degeneration of ovaries in 10 cows and two heifers. *Trichomonas fœtus* was detected in one cross-bred cow.

**Punjab**—In the Punjab, 126 œstrus cycles in different breeds of cattle and buffaloes were studied, and 39 calvings were followed up. Fœtal membranes were expelled on an average in 3·55 hours after calving. Sub-functional ovaries were suspected in seven cows and nine buffaloes. Three of the four repeat breeder cows responded to intra-uterine treatment with Lugol's solution.

The Regional Sterility Officers devoted considerable time to teaching animal gynæcology and obstetrics to the veterinary college students.

During the year under report, the cattle sterility scheme was extended so as to establish five more regional centres at the veterinary colleges in the States of Orissa, Andhra Pradesh, Madhya Pradesh, Kerala and Assam. The officers recruited for these centres were deputed to Sweden for advanced training.

### PISCICULTURE

#### PROCESSING OF INEDIBLE FISH

This scheme was initiated in 1954 in West Bengal with the object of finding out the reasons, chemical or otherwise, of the supposed inedibility of some varieties of sea fish caught by the trawlers, to develop methods of removing such causes, and to produce economic products out of the protein contained in the tissues of such fish. During the year under report, optimum hydrolysing conditions were studied with the use of sulphuric acid and hydrochloric acid under controlled time and other conditions. Hydrochloric acid was found to be a better hydrolysing agent and more economical than sulphuric acid.

### APICULTURE

**Bee Research Station, Coimbatore**—The Scheme for the establishment of a regional bee-keeping research station at the Agricultural College and Research Institute, Coimbatore, Madras was initiated in 1951, with the object of investigating the possibilities of improving the honey-yielding capacity of the Indian honey bee (*Apis indica*) by selective breeding and studying certain fundamental as well as practical aspects of bee-keeping. During the year under report, drumstick flowers were found to be a good source of nectar throughout the year and the concentration varied from 12 per cent. to 69·0 per cent. according to weather conditions. Plants of *Gliricidia* flowered from December to April and secreted nectar in fair quantities, the concentration varying from 26 per cent. to 71 per cent. In tamarind, which flowers during May and June, the nectar concentration was 32·02 per cent. to 40·50 per cent. Maximum extractions from selected colonies weighed 19 lb. 12 oz., 12 lb. 9 oz., and 13 lb. 14 oz. In general, greater wing length was directly correlated with higher honey yield. Variations in brooding and rearing activities of bee colonies were believed to be directly affected by weather conditions rather than by the availability of pollen in nature or supplemented food. Periodical removal of brood combs from very vigorous colonies having brood in all the frames in the brood chamber and their substitution by foundation combs prevented the development of swarming.

The northern regional bee-keeping research station sanctioned for Himachal Pradesh has not yet started functioning.

CHAPTER IV

# STATISTICAL RESEARCH

## ADVISORY WORK

The Statistical Branch of the Council continued its advisory work relating to the design of agricultural and animal husbandry experiments and the interpretation of their results, examination of technical programmes and anuual reports of the Council's scheme and the scrutiny of statistical papers received for publication in the Council's Journals. A number of statistical enquiries received from the Food and Agricultural Organization of the United Nations, the Central Government, State Governments' Commodity Committees and other Institutions, were also dealt with.

## RESEARCH

**Fertiliser Demonstrations on Cultivators' Fields**—The Fertiliser demonstrations are being conducted in the different states under a scheme sponsored by the Government of India. The fertilisers required for these demonstrations are supplied free of cost by the Technical Co-operation Mission, U.S.A. The objectives of the demonstrations are to encourage extensive use of commercial fertilisers by the cultivators with a view to increasing crop production and to popularize the use of new fertilisers like urea, ammonium sulphate nitrate, muriate of potash and nitrolime. The demonstrations also provide extensive data for estimating crop responses to various fertilisers and fertiliser mixtures under a wide range of soil and climatic conditions in the country.

During the year under report, data pertaining to the demonstrations carried out in *kharif*, 1956-57, were statistically analysed. The data processed pertained to about 7,000 demonstrations from nine states mostly on paddy crop. Other crops for which data were received and studied were *jowar, bajra* and cotton from Bombay state and *jowar* from Uttar Pradesh. Data relating to *rabi*, 1956-57, are under statistical examination. Summary of the results pertaining to *kharif*, 1956-57, is given below :

The response to 30 lb. nitrogen for paddy-crop varied from four to six maunds per acre with an average of 5·2 md. per acre. When the level of nitrogen applied was increased from 30 lb. to 60 lb., an additional response of 3 to 5 md. per acre over the plots with 30 lb. N per acre was obtained. The response to nitrogen at both the levels was greater for the red loam soils than for the shallow clay loam soils.

Demonstrations to show the effect of superphosphate were conducted in Bombay and Madhya Pradesh. In both the States the average responses to 30 lb. and 60 lb. $P_2 O_5$ per acre were about 6 and 10 maunds respectively.

Response to 30 lb. $P_2 O_5$ per acre over a basal dressing of 30 lb. per acre of nitrogen varied generally from 1/2 to 3 maunds per acre except for the coastal alluvium soils of Andhra Pradesh, where a response of 7 to 9 maunds of paddy was obtained.

The mixed fertiliser used was generally 14 N: 7 $P_2 O_5$. The dosage tried varied from 180 lb. per acre in Madhya Pradesh to 375 lb. per acre in Madras State. There was generally good response to mixed fertiliser in all the states, but in most of the States the responses were not appreciably different from that to an equivalent amount of nitrogen alone. Extra response to 20 lb. $K_2 O$ applied over mixed fertiliser, varied from about 3 to 4 maunds per acre in parts of Assam, Madhya Pradesh and Bombay State. While in Chingleput and in Madurai districts of Madras State, very low responses were indicated.

Application of ammonium sulphate at 20 lb. N/acre gave on an average almost cent per cent. return on an investment of Rs. 25·50. Profit from the application of the same quantity of nitrogen in the form of urea or ammonium sulphate nitrate will be greater, since these fertilizers are cheaper than ammonium sulphate and the responses to them were more or less of the same order as that for ammonium sulphate.

**Co-ordinated Agronomical Experiments Scheme**—The Coordinated agronomic experiments scheme is a scheme included under the Second Five Year Plan and is a continuation and extension of the T.C.M. "Fertiliser use Project" under which complex factorial experiments, relating to fertiliser use were conducted on 15 acre farms at 18 selected centres and simple trials on cultivators' fields in 22 Community Project areas. The programme of work under the Coordinated Scheme included model agronomic experiments at selected centres and simple trials on cultivators' fields.

(*a*) Model Agronomic Experiments—Model agronomic experiments consist of eight types of complex factorial experiments planned by a Committee of the Indian Council of Agricultural Research set up for the purpose. These types included manurial, cultural, rotational and irrigational experiments. The number of centres at which the complex experiments are proposed to be undertaken is 34, including the 18 centres in which experiments were conducted under the T.C.M. Project. These 34 centres are distributed over various agro-climatic regions of the country. The object of the complex experiments is to obtain scientific information on the individual, aggregate and cumulative effects of numerous growth factors under different conditions of soil, climate and cropping.

During the year 1957-58, 151 experiments were conducted at 30 centres. The statistical analysis of the data from experiments carried out in *kharif* 1956 was completed and that for *rabi* 1956-57 is in progress. The salient features of the results for *kharif* 1956 are given below:

Under the scheme, 56 complex experiments were conducted at 18 centres, of which 40 experiments were conducted on paddy crops, the results for which are given below.

Response to nitrogen at 30 lb./acre varied from 1·5 to 3·7 md./acre in the different centres except at Bagwai, M.P., where a high response of 5·8 md. per acre was obtained. When the dose of nitrogen was increased from 30 lb. to 60 lb., per acre, the additional response was not appreciable, except at Barrapalli centre in Orissa, where the response increased from 3·6 to 7·8 md. per acre.

Application of phosphorus at 30 lb. per acre gave almost the same response to nitrogen at Bagwai centre, while at other centres the response to phosphorus was low, varying from 0·9 to 2·3 md. per acre. With the increase in the level of phosphorus from 30 lb. to 60 lb. the additional response obtained was small and uneconomical, except at Barapalli, where the additional response was 2·4 md. per acre.

The response to potash was small at all the three centres where it was tried, the average increase in yield being 0·9 md. per acre at 30 lb. per acre of $K_2O$. There was no additional response at the higher dose of 60 lb. per acre.

There was no evidence of interaction between the nutrients, N, P and K, in the different experiments tried during the year.

Applications of nitrogen in the form of ammonium sulphate or urea at different times, from just before planting to a few weeks before flowering in either full dose or split doses, did not show significant differences in responses. But there was an indication of lower responses to application at planting time at some centres.

Application of phosphate in the pellet form proved to be more efficatious than both broadcasting at puddling time and dipping the seedlings in mud slush mixed with the fertilizer.

(*b*) Simple Trials on Cultivators' Fields—The aim of the simple fertiliser trials is to estimate the average responses to different types of fertilisers in a given tract and to study the interaction of these responses with local variations so that suitable manurial schedules may be drawn up for the benefit of cultivators. It is proposed to cover under the scheme 200 districts, having an assured adequate water supply through irrigation or rainfall. Each district will be divided into four homogeneous zones and in each zone 31 experiments will be conducted on randomly selected fields of cultivators. These include experiments on a *kharif* cereal, a *rabi* cereal, a cash crop, an oilseed crop and a legume crop. In the important jute growing States of Bengal, Assam, Bihar and Orissa, experiments on jute will also be included.

The field staff appointed under the scheme in the different States are given through training by a Statistician of the Council and an Agronomist of the Indian Agricultural Research Institute, New Delhi.

During the year 1957-58, seven States have conducted, in all 843 experiments during the *kharif* and the *rabi* seasons. The data are under statistical examination.

**National Index of Field Experiments**—The scheme of the National Index of Field Experiments was started by the Council in October, 1955. The object of the scheme is to prepare and maintain on specially designed index cards, the summary of all the field experiments conducted in India, at a central place namely Delhi, which will be available for ready reference to all the agricultural research workers in the country. The years of experiments covered by the scheme are from 1935 to the present, the period prior to 1935 having been covered mainly by Vaidynathan's Catalogue (1935) of Fertiliser Trials in India.

The method of collection of data of the experiments and staff employed under the scheme have been reported last year.

The progress of work under the scheme is satisfactory. About 5,000 experiments have been reported by the regional staff so far to the headquarters of the Council. The numbers of experiments reported to the Council during the year is of the order of 3,000 out of which about 1,800 experiments belong to the period 1935—53 and the rest were post-1953 experiments.

**Analysis of Manurial Trials, Bihar**—Simple fertiliser trials on cultivators' fields were carried out from 1948 onwards by the Bihar State and are still in progress. The Statistical analysis of the data is being carried out in the Statistical Wing of the Council. During the year, a consolidated report covering the results from 1948-49 to 1955-56 was prepared. In this report, data of about 18,000 experiments carried out in 17 districts of Bihar on paddy, wheat, maize, maruwa and gram have been summarised. Responses to nitrogen, phosphorus and potash along with the standard errors were worked out for each district and also on different soil types. The average responses obtained are given below for different crops:

| | Response in mds. per acre | | | | |
|---|---|---|---|---|---|
| | Paddy | Wheat | Maize | Maruwa | Gram |
| 30 lb. N per acre | 5·2 | 3·4 | 3·6 | 2·7 | 2·0 |
| 40 lb. $P_2$ $O_2$ per acre | 4·2 | 3·2 | 2·5 | 2·8 | 3·2 |
| 40 lb. $K_2$ O per acre | 1·7 | 1·4 | 1·8 | 2·3 | .. |

In general, the response has been highest for nitrogen, followed by phosphorus. Potash also gave a response which, however, was much lower than that for nitrogen and phosphorus. Comparison of superphosphate with bone meal indicated better responses to phosphate both for wheat and paddy, the differences in yields for the two fertilisers being 2·1/2 and 3 maunds per acre, respectively, for the two crops. The responses to gneiss soils were generally better than those for alluvium soils.

**T.C.M. Agronomic Trials**—An All India Scheme of simple fertiliser trials on cultivators' fields was initiated by the Government of India in 1953 in co-operation with the American Technical Co-operation Mission. Under this scheme, simple manurial trials on rice and wheat were carried out in 22 community project centres and complex factorial experiments at 18 selected blocks, distributed in various parts of the country. The scheme terminated in March 1956. During the three-year period, 136 complex experiments and about, 2,400 fertiliser trials were conducted on wheat and 168 complex experiments and about 1,700 simple trials were carried out on paddy. The statistical analysis of this large body of data was carried out and reports summarising the information obtained in these trials have been prepared. 9 nP. The main conclusions have been that the responses to nitrogen were quite substantial and, in terms of cleaned grains, were almost equal for wheat and rice. The average response to 20 lb. nitrogen was about 3 md. of foodgrain. Application of phosphorus also gave good response at most of the centres, while the response to potash was limited to a few areas and even in those areas the response was generally much lower than that to nitrogen or even to phosphorus. Considering the cost of fertiliser and the price of produce, and with the limited supply of fertilisers available at present, it has been found that about 20 lb. nitrogen plus 20 lb.

phosphorus is near about the optimum dose for paddy. As regards wheat, a higher dose of nitrogen with a smaller quantity of phosphorus was indicated as the optimum. 9 nP. Another interesting conclusion has been that, for maximising the overall production in the country with the limited supply of fertilisers, nitrogen and phosphorus should be used in separate areas at least in so far as immediate crop production is concerned. Comparison of various nitrogenous fertilisers generally failed to show any substantial difference in response to different forms, indicating thereby that the use of any one of these fertilisers should depend largely on the relative availability. The cost interaction of fertiliser response with other factors such as irrigation, varieties, bulky manures etc. were also studied to a limited extent in complex experimental centres. Similarly, the optimum time and method of fertiliser application was also investigated. The general indications were that within the ranges considered, there were no appreciable interactions of fertiliser responses with these factors.

Analysis of Long Term Experiments—Data of six long-term manurial trials on paddy, conducted at the farms, Chinsura, Suri and Berhampur in West Bengal, and of one long-term rotational-cum-manurial trial at Indore Institute of Plant Industry, were examined to study the relative effects of organic and inorganic manures on crop production and soil fertility. 9 nP. Continuous application of moderate doses of ammonium sulphate on paddy for six to eight years had no deleterious effect on non acidic soils, but application of excessive doses of ammonium sulphate year after year on neutral and acidic soils, gave decreased responses and indicated deterioration in yield. Application of farm-yard manure or lime or bone meal was not effective in counteracting this effect, but on acidic soils F.Y.M. was effective in preventing deterioration with moderate dose of ammonium sulphate.

On the medium black soils of Central India, of below average fertility, farm-yard manure was found to give low direct responses of cotton and *jowar*, as compared to responses to ammonium sulphate and ground-nut-cake. Application of manures and fertilisers on dry wheat gave no direct response, but the following *jowar* crop benefited. Farm-yard manure applied to *jowar* or wheat left a residual response on the succeeding crop in the rotation. Judged from the trend of yields of *jowar* and cotton in plots treated with ammonium sulphate or groundnut-cake which gave heavier crops, there was an indication of deterioration of yields in the course of the experimental period. Application of farm-yard manure or phosphorus, which gave low responses, did not indicate such a trend.

**Estimation of Lactation Yields of Cows**—For assessing the progress of dairy development schemes on the basis of the average lactation yield of cows in the scheme, and to exercise a strict supervision on milk recording of dairy cattle in farms, it is necessary to evolve a suitable sampling technique. With this object in view the complete daily yield records during the first lactation of 65 Tharparkar cows at the Government Cattle Farm, Patna, 36 Hariana cows at the Indian Veterinary Research Institute, Izatnagar, 34 Red Sindhi cows at the Livestock Research Station, Hosur and of 41 Hariana cows under the Council scheme at the Government Livestock Farm, Hissar were collected and analysed.

The results revealed that the procedure of recording daily milk yields at regular intervals after a random start, apart from being convenient in practice for adoption, is more efficient than simple random sampling. The study was

confined to recording at systematic intervals of one week, two weeks, four weeks and eight weeks. It was also found that recording milk yield at weekly intervals should be considered reasonably satisfactory for the purpose of rational supervision of milk recording of individual cows on farms (1·5 to 2 per cent. standard error of the estimate of lactation yield) even though it cannot be relied upon in cases where the lactation yield is required to be estimated with a margin of error of less than 4 per cent.

It was observed that the number of cows to be milk-recorded was almost the same for a given herd size and the level of precision irrespective of the interval of recording.

The findings were applied for formulating a suitable plan for milk recording in development scheme such as the key village scheme. It was found that on the basis of the daily milk yields of 75 selected cows recorded at monthly intervals, the average lactation yield of the cows in a key village block can be estimated with a standard error ranging from 3 to 6 per cent. This range is reduced to 2 to 4 per cent. when 150 cows are selected for milk recording at bi-monthly intervals.

Further studies on this subject are in progress.

**Estimation of cost of milk production—Madras**—A survey to evolve a suitable sampling technique for an objective assessment of the cost of production of milk was carried out in Delhi State during 1953—55. The reports on the statistical analysis of the data, were considered by the Scientific Committees of the Council, which found the results encouraging and recommended that the enquiry be repeated in a few other urban centres, as well as in rural areas in different parts of the country, where different conditions obtained before a sampling technique could be given out for adoption. It was accordingly proposed to conduct the survey in two large urban areas with hinterland and rural area, like Calcutta and Madras, during the course of the Second Five Year Plan at an approximate cost of Rs. 4·9 lakhs. The field work commenced in Madras in 1957.

The Plan of the survey for the scheme is similar to the one adopted for the survey conducted in Delhi.

A house to house enumeration was carried out during August and September, 1957 in the whole of the urban area of the Madras city and twentyfour randomly selected villages each in the suburban areas of Madras city and rural areas of Madras State to collect information regarding the cattle and buffaloes maintained. On the basis of the sampling frame so obtained, a suitable sample of 54 stables for the urban area and 96 stables each for the suburban and rural areas were selected at random in each selected village. Each selected stable is visited one day in a week, both morning and evening, by an enumerator and items of information like milk yield, quantity and composition of feeds etc. are collected by direct weighment, while data like prices and wages are obtained through enquiry. Also, from each selected stable, two samples of milk (one from cow and the other from buffalo, as the case may be) are being collected once in a fortnight to determine the fat percentage. The detailed enquiry commenced from October, 1957 and will continue for a period of two full years in order to cover one calving interval for a majority of animals and also to have two sets of observations on seasonal variations. The data received at the headquarters are being processed and compiled for statistical analysis.

**Indigenous Goat Breeding Scheme—Hissar**—As referred to in last year's report, the data collected under the Council's scheme at the Government Livestock Farm, Hissar, from the period December, 1939 to March, 1957 on Beetal goats, are being statistically analysed.

During 1957-58 some studies on lactation yield were completed. The studies included the generationwise comparisons, daughter-dam comparisons, progeny testing and evaluation of sire indices of bucks used on the farm, the estimation of repeatability and heritability and the effect of preceding dry period. In breeding coefficients of nearly 2,000 progeny were calculated out of about 3500. Some studies on kid mortality were also completed.

Studies on other characters of interest such as birth weight, age at first kidding, lactation period, yield per day of lactation etc. will be taken up during the course of the year 1958-59.

**Milk Composition Data**—As reported last year random samples of genuine milk were collected from Bihar, the Punjab and Bengal, and their density, fat content and solid non-fat content studied with a view to reviewing the quality standards for market milk. The results of the analysis of Bihar data were given in the last report. During the year under report, the Bihar data were further examined and the analysis of the Punjab data was also commenced. The salient features are given below:

1. From the Bihar data the tolerance limits at different levels for each season were estimated from (*i*) raw data, (*ii*) normal approximation to the distribution and (*iii*) appropriate Pearsonion curves. It was observed that at higher levels the three sets of limits agree to a considerable extent. A seasonwise study revealed that as against winter and monsoon, the corresponding limits for summer were lower for all the characters except for fat percentage of buffalo milk.

2. To examine the relationship between fat percentage and density, regression analysis was carried out and it was found that in the case of buffaloes for winter and monsoon seasons and for cows in the monsoon season, the relationship was linear; while for cows in winter and summer seasons the relationship was found to require a quadratic curve for satisfactory fit. But in the case of summer samples of buffalo milk the analysis showed no significant relationship between fat and density.

3. The official limits prescribed for Bihar State were examined in the light of the data obtained. It was found that under the prescribed limits, a little less than half of the producers of genuine milk would be penalised if milk of individual cows were sold separately.

4. In the case of the Punjab data, buffalo milk had an average fat content of 6·90 as compared to 4·64 for cows. For density and solid-non-fat also, buffalo milk had significantly higher values, viz. 1·0303 and 9·65 respectively as against 1·03 and 8·59 for cows. The coefficients of variation were highest for fat percentage (25 for buffaloes and 30 for cows), about one quarter as much for solid-non-fat and less than 0·3 per cent. for density.

Further studies on the data are in progress.

**Rinderpest Eradication Scheme**—It was mentioned in the report for 1956-57 that the campaign was in progress in the States of Mysore, Bombay and Andhra Pradesh. During the period under report, in addition to the above States, work was carried out in Orissa, Bengal, Bihar, Uttar Pradesh, the Punjab and Jammu and Kashmir. The progress of work done during 1957-58 was assessed from the weekly returns received from the field staff. The salient results are given below. Eleven million animals have been vaccinated during 1957-58 and 13·5 millions of doses of vaccine used. The percentage of animals vaccinated in the villages visited averages 77. On an average 124 doses of vaccine have been used for vaccinating 100 animals. The average number of vaccinations carried out per individual per week works out to 290, varying from 504 for the Punjab to 209 for West Bengal.

**Study of milk yield, breeds and management practices of bovines in Uttar Pradesh**—With the objects of (*i*) evolving a suitable sampling technique for estimating annual milk production and (*ii*) collecting reliable data on various practices relating to the rearing and feeding of cattle and buffaloes in a tract, the Council has been undertaking a series of pilot sampling investigations in the different animal husbandry regions of the country, covering a typical tract in each region during the years of the Second Five Year Plan. The first year's investigation was carried out during 1956-57 in the Punjab States of the northern Animal Husbandry Region. The technical details of the investigation were already reported last year.

The second year's programme of work was undertaken during 1957-58 in the portion of U. P. falling in the Eastern Animal Husbandry region. The plan of work adopted during this investigation was analogous to the one used during the previous investigation except that a sample of 20 tehsils as against 15 tehsils in Punjab was selected for this investigation.

The field work was entrusted to 20 enumerators. As in the last year the supervisory staff consisted of one field officer, three inspectors and three supervisors.

Results of the analysis of the survey conducted in Punjab reveal that in respect of cows of rural areas in the stage the estimated average daily milk yield per cow in milk varies from 2·78 seers in summer to 2·05 seers in winter, the overall average for the year being estimated as 2·40 seers. In the urban areas, while the average for the State is 3·79 seers per cow in summer, it decreases to 2·94 in the rainy season and to 2·61 seers in winter season. The overall daily average for the entire year for urban cows in milk turns out to be 3·08 seers per cow. The average daily milk yield of buffaloes in milk in rural areas is 3·87 seers in summer, 4·47 in rainy season and 4·64 in winter. The overall average per buffalo in milk for the entire year is 3·34 seers per day. The corresponding estimates for the urban areas have been obtained as 5·44 seers in summer, 5·36 seers in the rainy season and 6·11 seers in the winter season, the estimated daily average for the entire year being 5·70 seers per buffalo in milk

**Study of cultivation practices, area and yield of pepper crop in Kerala State (1956-57)**—A pilot sample survey on pepper crop was repeated in 1956-57 in Kerala State excluding the pepper growing districts of Malabar and South Kanara which were transferred from Madras State on account of reorganization of States. The field work of this survey was completed in May, 1957. The analysis of the data collected during the survey was completed by March, 1958.

The average yield of black dry pepper per bearing standard was estimated as 21·5 oz. The estimated total number of bearing standards was 25·7 millions and the total production of dry pepper was estimated as 15·400 tons. Supports which are popular in use for pepper cultivation are found to be *Murukku Maruthu Kilingil*, Arecanut, *Perzhu*, Mango, and *Payyani*, which together account for nearly 65 per cent. of the total population of standards. Of these, *Marukku* is the most popular and accounts for 31 per cent. of the total. Popular varieties of pepper are *Kaniakadan*, *Karimunda*, *Mundi*, *Kottanadam*, *Narayan*, and *Narayakodi*. *Kaniakadan* is the most popular and accounts for about 20 per cent. of the total. It was observed that about 54 per cent. of the plots under pepper crop were treated with manure. The yield rate for the manured plots exceeded that for unmanured one by 8·6 oz. per standard. It has also been observed that about 46 per cent. of the plots were damaged by diseases, pests etc., and that the average yield rate of dry pepper per standard for these was about 19 oz. as against that of 24 oz. for the undamaged ones.

**Survey of Fertilizer Practices**—A pilot sample survey was started in the Barabanki District of Uttar Pradesh in October, 1957. The field work of the survey was completed in October, 1957. The data obtained for the *rabi* crops were analysed.

The total consumption of ammonium sulphate, farm yard compost and lona soil during the *rabi* season of 1956-57 was estimated at 1,307 tons, 507,000 tons and 68,000 tons respectively. About 26 per cent. of the area in the district during *rabi* season of 1956-57 was observed to be manured. About 21 per cent. of the area in the district was found to be benefited by farm-yard manure and compost, 10 per cent. ammonium sulphate and 2 per cent. by lona soil. About 60 per cent. of the area under wheat which is the major *rabi* crop of the district was manured; 24 per cent. by ammonium sulphate, 49 per cent. by farmyard manure and compost and only 1 per cent. by lona soil. Ammonium sulphate at the rate of 54 lb. per acre under the irrigated condition as against 47 lb. per acre under the unirrigated was applied to wheat, the over all rate of application being 53 lb. per acre. The corresponding rates of farm-yard manure and compost were 4·5 tons and 5·1 tons per acre respectively, the over-all rate of application being 4·6 tons per acre.

A similar type of survey was started in the Ferozepur District of the Punjab in October, 1957 and the field work of the survey is in progress.

**Area statistics of tobacco**—A pilot sample survey with the object of examining the nature and sources of discrepancies in the tobacco area figures as reported by the Revenue Department, and by the Central Board of Revenue, and to suggest the methods for improving the accuracy of area statistics of tobacco was initiated in the Guntur District of Andhra Pradesh. The field work started in February, 1958 and carried out by six *ad hoc* enumerators in 34

selected villages. The administrative control of the scheme was exercised by the Bureau of Economics and Statistics, Andhra Pradesh, and the Council provided the technical guidance. The field work was closely supervised by the officers of the Council and that of the Bureau of Economics and Statistics, Andhra Pradesh. The scrutiny and tabulation of the data collected is in progress.

**Pilot Survey for Estimating Livestock Number**—Pilot surveys for evolving samples technique for estimating the livestock number were conducted in Etawah District of Uttar Pradesh in 1950, in Wardha District of the then Madhya Pradesh in 1953, and in the former Bombay State in 1954. Preliminary reports on these surveys were prepared and submitted to the Statistical Committee of the Council. Since the results obtained in these surveys are of wide applicability for estimating the livestock numbers annually, it was, therefore, thought necessary that the results should be consolidated and a final report published. The report has now been finalised and is ready for publication.

AGRICULTURAL ECONOMICS

**Study of intensive cultural practices on small holdings**—With the object of determining economic holding sizes under intensive cultural practices, which may provide full employment to common cultivators, a scheme has been undertaken by the Agricultural Department of Calcutta University for a period of five years, with effect from September 1956. According to the plan, nine cultivators' holdings have been randomly selected for collection of data on input and output of agricultural production. Side by side, similar data are being collected from three artificial holdings taken on the experimental farm for comparison purposes. Preliminary report on the data collected up to August 1957 has been prepared.

**Method and practice of farm accounts**—A pilot scheme on the "Method and practice of farm accounts" was undertaken by the Gokhale Institute of Politics and Economics, Poona, in 1955 with the object of exploring the possibilities of popularising the keeping of farm accounts by the farmers. In all, 478 farmers were selected to keep the records. Of these records, 205 were incomplete and the rest formed the basis of analysis. The final report will be published in due course.

**Non-farm employment in Thana district**—A pilot scheme on non-farm employment was conducted by the Department of Economics, University of Bombay in Thana District of Bombay State. The objective of the scheme is to study the nature and extent of non-farm employment. The final report is under preparation.

**Agro-economic aspects of a multi-purpose river valley project**—A scheme with the object of studying the agro-economic problem in the multi-purpose river valley project areas was undertaken by the Delhi School of Economics. Their study was concentrated to the problems in the Damodar Valley Project areas. The data has been collected with the co-operation of the officials of the Damodar Valley Corporation and Governments of West Bengal and Bihar. The report embodying the findings has been prepared by the Fellow and will be soon submitted to the Council.

OPERATIONAL RESEARCH

The statistical assessment of the result of the Grow More Food Campaign, for which a technique was developed by the Indian Council of Agricultural Research is an example of operational research in agriculture. Another field for such research is the study of agricultural and animal husbandry practices in different tracts. It is only through such operational studies that an accurate quantitative assessment of the present condition of farming in relation to use of fertilizers and manures, improved seeds etc., and of livestock in relation to breeds, feeding etc., can be made. Such surveys form the most reliable basis for formulating developmental plans and will serve as bench marks for periodic assessment, and subsequently for assessing the degree of progress achieved in the use of improved implements, fertilizers, manures, improved seeds, better breeds of livestock, better standards of feed etc.

The following papers written by the members of the Statistical Wing have been published or accepted for publication during the term under report:

| *Author* | *Title of the paper* |
|---|---|
| Dr. V. G. Panse .. .. .. | Some observations on the problems of estimating Farm Costs—Proceeding of the F.A.O. Development Centre on Farm Planning and Management for Asia and the Far East, New Delhi, 1957. |
| Dr. V. G. Panse .. .. .. | Some comments on the objective and method of 1960 World Census of Agriculture, International Statistical Institute Meeting at Stockholm, 1957. |
| Dr. V. G. Panse .. .. .. | Problems and Techniques in the Study of the Cost of Production in Agriculture—F.A.O. Seminar on Agricultural Price Policies, March, 1958. |
| Dr. V. G. Panse, P. V. Sukhatme and K.V.R. Sastry .. .. .. | Sampling Technique for estimating the Catch of Sea Fish in India—March 1958. |
| Dr. V. G. Panse .. .. .. | Genetics of Quantitative characters in relation to Plant Breeding—*Indian J. Genetics and Pl. Breeding*, 1958. |
| Dr. B. V. Sukhatme .. .. | Test of the Hypothesis that two Populations differ only in Location *Ann. Math. Stat.* 29, 1958. |

| *Author* | *Title of the paper* |
|---|---|
| Shri M. N. Das .. .. .. | Analysis of Covariance in Incomplete Block Designs with or without Missing Plots—*J. Indian Soc. Agric. Statist., 8.* |
| Shri M. N. Das .. .. .. | Bio-assays with non-orthogonal data—*J. Indian Soc. Agric. Statist. 9* (1). |
| Shri M. N. Das .. .. .. | A generalised balance design—*J. Indian Soc. Agric. Statist. 9*(1). |
| Shri T. R. Puri .. .. .. | Estimation of the effective number of Segregating factors in quantitative inheritance—*J. Indian Soc. Agric. Statist., 8.* |
| Shri N. C. Giri .. .. .. | On reinforced P.B.I.B. Designs—*J. Indian Soc. Agric. Statist. 9*(1). |
| Shri V. N. Amble and Shri K. S. Krishnan and Shri J. S. Srivastava | Statistical Studies of Breeding data of Indian Herds of Dairy Cattle—Red Sindhi Herds at Hosur and Bangalore—*J. Vet. Sci. 28, 1958.* |
| Shri T. A. Ramasubban .. .. | $AX^2$ approximation Gini's mean difference—*J. Indian Soc. Agric. Statist. 8.* |

### MEETINGS AND SYMPOSIUMS

The Eleventh Annual Meeting of Indian Society of Agricultural Statistics was attended by several members of the Statistical Wing. Members of the staff of the Statistical Wing who contributed papers were Dr. A. R. Roy, Dr. B. V. Sukhatme, Shri M. Rajagopalan, Shri K. C. Raut, Shri B. S. Gill, Shri M. N. Das, Shri P. N. Bhargava, Shri N.C. Giri, Shri M.G. Sardana, Shri N.C. Khandakar, Shri T.P. Abraham, Shri V. Y. Rao, Shri D. Singh and Shri S. G. Mohanty. Dr. V. G. Panse and Dr. G. R. Seth participated in the symposiums on 'Role of Operational Research in Agriculture' arranged at the session.

The 45th session of the Indian Science Congress held at Madras was attended by several members of the Statistical Wing including Dr. V. G. Panse, Dr. G. R. Seth, Dr. B. V. Sukhatme, Shri M. N. Das, Shri M. C. Giri and Shri S. G. Mohanty. Dr. Panse participated in the symposium on 'Statistical Methods in Economics' and Shri M. N. Das and Shri S. G. Mohanty took part in the symposium on 'Biological Assays' arranged at the session. Dr. B. V. Sukhatme, Shri M. N. Das, Shri N. C. Giri and Shri P. N. Bhargava contributed paper-reading in the session.

**Agriculture Price Stabilisation in E.C.A.F.E. Region**—The F.A.O. of the United Nations with co-sponsorship of E.C.A.F.E. and in cooperation with the Government of India conducted a centre on policies to support and stabilise agricultural prices and income in Asia and the Far East at New Delhi from 21st March to 3rd April, 1958. The Centre was attended by Thirtysix delegates and observers from fourteen countries besides four consultants and specialists

from F.A.O, E.C.A.F.E. and the Government of India. Dr. M. S. Randhawa, Vice-President of the I.C.A.R. was the Director of the Centre. Mr. P. G. H. Barter of F.A.O., Dr. E. Ojala, E.C.A.F.E., Dr. V. G. Panse, Statistical Adviser, I.C.A.R. and Dr. S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, were the Co-Directors.

The discussion at the Centre revealed that the main objectives of price support and stabilisation policies should be the elimination of the sharp fluctuations in agricultural prices, the improvement of marketing practices, which in turn would ensure to the producer a large slice of the consumer price and the provision of a favourable economic and social climate to expand agricultural production. The use of a single formula to establish the desirable level or range at which agricultural prices should be established was considered inadequate and involving the risk of undue rigidity. It was suggested that all the relevant factors like changes in production costs, in the prices of things farmers buy and sell and in the prices of competing crops etc. and the views of the representatives of various interests be taken into account in determining price levels, and that the prices should be announced well in advance of the planting season. Government marketing operations, combined with maintenance of reserve buffer stocks and regulation of imports or exports of basic foods were considered most suitable for implementing price stabilisation policies. Measures like assistance in providing irrigation, subsidies on fertilizers and other farm requisites, etc. were considered essential for developing agriculture in the region but it was emphasized that they must supplement and not replace measures of price stabilisation and support for improving agricultural production. To keep retail prices within reasonable limits, properly worked out measures like consumer rationing coupled with price control, release of government stocks and regulation of supplies, were considered to be necessary to counter inflation, but they should be gradually transformed into producer subsidies for raising productivity and output. The Centre stressed the need of carrying out studies for the formulation of various economic indicators and determining cost of production of crops to aid in the proper framing of price policies.

### TRAINING

The post-graduate training courses in Agricultural Statistics were conducted by the Council as usual. Three students, who had successfully completed their Diploma First-Year Course in August, 1957, were admitted to the Second-Year Diploma Course, Seven students joined the First-Year Diploma Course at the same time. Twelve students, deputed by various State Governments, Central Research Institutes and other recognised Institutions were admitted to the Certificate Courses in August, 1957. Out of these, four students joined the Junior Certificate Course and eight, the Senior Certificate Course. Shri Slamet Sudir Dogo, an official of the Indonesian Government, deputed by the F.A.O. joined the Council during July, 1957 to undergo training in sample survey techniques for a period of one year. Shri Assafa Gizaw, an official of the Ethopian Government, deputed by the F.A.O. joined the Council in October, 1957 to undergo training in the sample survey techniques and design and analysis of experiments for a period of one year. Shri Tadashi Yamomoto, an official of the Japanese Government, joined the Council in February, 1958 for a

period of three months as an F.A.O. fellow to undergo training in collection and compilation of fisheries statistics with particular reference to the use of statistical methods in production and marketing statistics. During the year under report three students of the First-Year Diploma Course, eleven of the Senior Certificate Course, four of the Junior Certificate Course and one candidate for the proficiency test were declared successful at the final examinations conducted by the Council.

As a part of the training programme, a number of educational tours were undertaken by the students. The students of the First-Year Diploma Course were taken to the Government Main Agricultural Experimental Farm, Himayatsagar (Hyderabad), Southern Regional Station of the National Dairy Research Institute, Bangalore, Government Agricultural Farm, Coimbatore and Aarey Milk Colony, Bombay. They also attended the Eleventh Annual Session of the Indian Society of Agricultural Statistics at Bangalore. The Junior and Senior Certificate Course students were taken to the Government Main Experimental Farm, Himayatsagar (Hyderabad), Agricultural College and Sheep Breeding Station, Poona and Agricultural Research Institute, Anand, to acquaint themselves with the various aspects of research in progress and their statistical implications. In addition, the students of the training courses were occasionally taken to the Indian Agricultural Research Institute and its farms to make them acquainted with the research in progress and with layouts and conduct of field experiments on various crops. The students of the 1956-57 Course received training in official statistics for about a fortnight in different sections of the Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

At the request of the Directorate of Agricultural Marketing and Inspection, a short period training programme was organised in January, 1958 at the Statistical Wing of the Council for the benefit of Agricultural Marketing Officers. The training included lectures on (*i*) statistical method in the analysis of data relating to marketing of agricultural produce, (*ii*) quality control and (*iii*) sampling in agricultural marketing surveys.

About 35 seminars were held on subjects of current statistical interest and on investigations in progress at the Statistical Wing of the Council. Members of the staff and a number of eminent statisticians participated in the seminar programme. The speakers included distinguished statisticians like Dr. F. Yates from Rothamsted Experimental Station, U.K., and Dr. K. Matusita, Director, Institute of Statistical Mathematics, Tokyo (Japan). Dr. F. Yates, Head of Statistics Department, Rothamsted Experimental Station, delivered a series of five lectures 'on the problem of operational research in agriculture' at the Statistical Wing. Dr. K. Matusita, Director, Institute of Statistical Mathematics, Tokyo, gave a series of lectures on the 'Theory of Decision Functions' and initiated series of discussions on 'Fundamental principles in Statistical inference'. Besides these, for the benefit of the students of the training courses, several lectures on soil chemistry, botany, entomology and dairy science, were delivered respectively by Dr. S. P. Ray Chaudry, Head of the Division of Soil Chemistry, Dr. S. M. Sikka, Head of the Division of Botany, Dr. Pradhan and Dr. Menon of the Entomology Division of the Indian Agricultural Research Institute, New Delhi and Dr. K. K. Iya, Director, National Dairy Research Institute, Karnal.

Dr. K. Matusita, Director, Institute of Statistical Mathematics, Tokyo, Japan, joined the Council as a visiting expert under the Colombo Plan in the month of January, 1958. During his stay of about three months, he advised the Council in its research programme carried out at its Statistical Wing and guided the students of its training courses in their research projects.

Dr. Frank Yates, Head of the Statistics Department, Rothamsted Experimental Station, United Kingdom, joined the Council during the month of February, 1958 as a visiting expert under the Technical Assistance Programme of the F.A.O. During his assignment with the Council for about three months he reviewed the implementation of the previous recommendations made by the Statistical experts. Drs. F. Yates and D. J. Finney, in 1953 on the training in Agricultural Statistics, and advised the Council on the various projects and training programmes undertaken by the Statistical Wing of the Council.

A large number of students from other institutions visited the Statistical Wing of the Council during the year under report and acquainted themselves with the training and research work in the Council. These included Senior Statisticians under training at the Central Statistical Organisation, New Delhi, students from the Indian Statistical Institute, Calcutta, and post-graduate students in statistics from Gauhati and Andhra Universities.

## PROBLEMS REQUIRING ATTENTION

Although considerable work has been done in developing efficient experimental designs for work on annual crops, little has been done in the case of horticultural crops. Lack of efficient experimental designs has been an important reason for experimental work on horticultural crops lagging far behind as compared to annual crops. Investigation to determine suitable experimental designs for horticultural crops is therefore urgently needed on the basis of careful examination of variability of the experimental material.

An economic analysis of experimental data on long-term crop rotations and manurial trials needs to be carried out and further research on the designs and methods of interpretations of results of such rotational trials should be taken up.

Another field which needs immediate attention is estimation of damage to the crop by insects, pests and diseases and the consequent reduction of yield. The statistical assessment of control of insects and pests by means of insecticides through controlled field experiments and bio-assays of sampling study in the field had received little or no attention in the past in India and deserves serious study in the light of the need of increasing the agricultural production.

Suitable sampling techniques for estimation of fruit production as well as lac production in the case of lac-bearing trees, on a given tree is very important both for experimental work and for sample surveys. As very little work in this direction has so far been done, it is necessary to initiate work immediately.

The progress in the development and use of sampling techniques for estimation of crop acreages and yields is remarkable, to which references have been made in the earlier reports. The I.C.A.R. has recently started pilot studies for developing suitable sampling techniques for estimating the production

of mango and orange crops on a limited scale. However this work needs further intensification to cover larger areas and other important fruit and vegetable crops.

Cowdung and compost as manure for increasing agricultural production, have attained special position in the Second Five-Year Plan. It is necessary that reliable esti nates of production of cowdung and compost and their utilization should be available so that proper planning would be done. Another field from which agro-economic data is urgently needed for improving the Plan is the area covered by multipurpose river valley projects.

While the statistics of agricultural production have been put on a sounder footing as a result of Council's work in evolving suitable random sampling techniques for the estimation of average yields of crops, the statistics of livestock production still remain far from satisfactory. A beginning has been made by the Council in dealing with the problem of estimation of milk production through pilot sample surveys. Pilot surveys are also necessary for evolving methods for estimating livestock products other than milk such as eggs, poultry and wool.

No study has so far been made in this country on the quantitative aspects of scientific breeding of buffaloes. It is desirable that the breeding data pertaining to herds of buffaloes available at the Military Dairy Farms should be studied.

Poultry keeping is now receiving great importance but very little data is available on the economics of poultry-keeping. It is considered necessary that investigations be initiated into the methods for assessing the cost of production of poultry and eggs.

CHAPTER V

## EXTENSION SERVICE

### TRAINING OF AGRICULTURE AND VETERINARY GRADUATES

It was reported in the last annual report (1956-57) that as one of the measures to increase the number of trained agricultural personnel required in large numbers for manning the Community Projects and National Extension Service Blocks, the Government of India had rendered financial assistance to various State Governments, for starting the following new agricultural and veterinary colleges and for expansion of the existing ones :

(1) *New Agricultural Colleges*

(*i*) Agricultural College, Vellayani (Kerala)
(*ii*) Govt. Agricultural College, Ludhiana (Punjab)
(*iii*) Agricultural College, Ranchi (Bihar)
(*iv*) Agricultural College, Udaipur (Rajasthan).

(2) *Expansion of the Existing Agricultural Colleges*

(*i*) Assam Agriculture College, Jorhat (Assam)
(*ii*) Agriculture College, Coimbatore (Madras)
(*iii*) Agricultural College, Hyderabad (Andhra Pradesh)
(*iv*) Agriculture College, Gwalior (Madhya Pradesh).

(3) *New Veterinary Colleges*

(*i*) Veterinary College, Trichur (Kerala)
(*ii*) Veterinary College, Cuttack (Orissa)
(*iii*) Veterinary College, Mhow (Madhya Pradesh)
(*iv*) Veterinary College, Tripathi (Andhra Pradesh).

(4) *Expansion of Existing Veterinary Colleges*

(*i*) Veterinary College, Gauhati (Assam)
(*ii*) Veterinary College, Patna (Bihar)
(*iii*) Veterinary College, Hissar (Punjab)
(*iv*) Veterinary College, Madras (Madras)
(*v*) Veterinary College, Osmania University, Hyderabad.

Good progress was made during the year under review in the construction of buildings etc. of the above colleges. As a result the total admissions in agricultural colleges increased from 1,292 in 1953-54 to 2,301 in 1956-57 and 2,661 in 1957-58. In veterinary colleges the corresponding increase in admission was from 597 in 1953-54 to 1,205 in 1956-57 and 1,123 in 1957-58.

There is at present no Veterinary College in Mysore State and the Govt. of Mysore approached the Central Govt. during the year, for financial assistance for starting a new veterinary college. The request of the State Government has been agreed to and the college is expected to start functioning from July, 1958.

### SHORT-COURSE IN VETERINARY SCEINCE

As one of the measures to meet the shortage of trained veterinary personnel required for various development schemes during the Second Five Year Plan, the Government of India is providing financial assistance to State Governments for running a two-year short course in veterinary science. Two batches of 843 and 667 trainees were admitted under the scheme during 1955 and 1956 respectively. The first batch of trainees has already completed their training. The target fixed for training of such personnel during the plan period is 2,000. The admissions during the first two years fell short of the target by about 490 and in order to meet this short-fall, sanction was accorded during the year under report, for admitting a third batch of trainees at five training centres i.e. one each in the States of Bihar, Uttar Pradesh, Rajasthan and two in Andhra Pradesh. The total number of admissions made in the third batch (1957-58) was 501. With the admission of this batch, the target of 2,000 prescribed for the above category of personnel will be fully achieved.

### POST-GRADUATE EDUCATION

The Joint Indo-American Team on Agricultural Research and Education appointed by the Govt. of India in November, 1954 had recommended that four State Agricultural Colleges and an equal number of State Veterinary Colleges should be developed into strong centres of post-graduate training on a regional basis with substantial grants-in-aid from the Central Govt. It has since been decided to give central financial assistance for starting post-graduate courses at the following colleges :—

*Agricultural Colleges*

(*i*) Govt. Agricultural College, Ludhiana (Punjab)
(*ii*) Agricultural College and Research Institute, Coimbatore (Madras)
(*iii*) Agricultural College, Nagpur (Bombay)
(*iv*) West Bengal State College of Agriculture, Tollyganj, Calcutta (West Bengal).

*Veterinary Colleges*

(*i*) Veterinary College, Mathura (U. P.)
(*ii*) Veterinary College, Madras (Madras)
(*iii*) Veterinary College, Patna (Bihar)
(*iv*) Veterinary College, Bombay (Bombay).

It is expected that post-graduate courses will start functioning at two agricultural colleges (Ludhiana and Coimbatore) and at two veterinary colleges (Madras and Mathura) from July, 1958. The courses at the remaining four colleges will start from the year 1959. Provision is being made for an annual admission of 40 students in each of the above colleges.

### SEMINARS ON TEACHING METHODS

The Indian Council of Agricultural Education at its meeting held in Lucknow during August, 1957, *inter alia* recommended that arrangements should be made for holding a few seminars on 'Teaching Methods' for the benefit of teachers employed in the agriculture and veterinary colleges. The seminars are intended to deal with the philosophy and objectives of teaching methods, the idea being to stimulate discussion which will lead to improvement in the methods of teaching in agricultural and veterinary colleges. This recommendation was accepted by the

Government of India and in pursuance thereof, the first Seminar for the teachers in Agriculture and Veterinary Colleges in the Southern Region comprising the States of Madras, Andhra Pradesh, Mysore, Kerala, Bombay and Orissa was held at Trivandrum in May, 1957. During the year under report, a similar seminar was held at Mussoorie for the benefit of teachers in Agriculture and Veterinary Colleges in the Northern Region from May 12 to 16, 1958. It was attended by teachers and principals from the various agriculture and veterinary colleges.

### REFRESHER COURSE FOR VETERINARY TEACHERS

The Joint Indo-American Team on Agricultural Research and Education in their Report submitted to the Govt. of India during 1955, observed that certain members of the teaching faculties in veterinary colleges do not possess sufficient academic attainment or proficiency to provide instructions at a level necessary for the B. V. Sc. degree. With a view to removing this deficiency, the Team recommended that special training conferences for teaching staff members in veterinary colleges should be arranged, preferably during the period when the Veterinary colleges are comparatively free and selected teachers can be spared. In pursuance of this recommendation, arrangements were made during 1957 for conducting Refresher Courses in Animal Anatomy and Surgery at the Bengal Veterinary College, Calcutta and in Bacteriology at the Indian Veterinary Research Institute, Mukteswar for the benefit of teachers in veterinary colleges. A similar refresher course in pharmacology for a period of six weeks at the Central Drug Research Institute, Lucknow, is being organized from May 26, 1958.

### SYLLABUS FOR VETERINARY COLLEGES

On the recommendation of the Indian Council of Agricultural Education a meeting of the Principals of veterinary colleges and certain subject-matter experts was held in New Delhi from August 5 to 9, 1957 to discuss and prepare model curriculum and syllabus on up-to-date lines for the veterinary Degree Course. The noteworthy features of the new curriculum are that, besides providing for a thorough training in fundamental and preclinical subjects like anatomy, physiology, bio-chemistry and management of livestock (including poultry) it caters for adequate and sound under graduate training in veterinary medicine and surgery, as well as in general animal husbandry subjects like animal genetics, animal breeding, animal nutrition and dairy science. The new curriculum also provides for some training in agriculture and cultivation of fodder crops, livestock marketing, economics and statistics. The model syllabus will be referred to the I.C.A.E. for approval at its next session to be held in August, 1958 and circulated to the Universities and veterinary colleges for suitable action.

### INTER-INSTITUTIONAL ARRANGEMENTS

Under the Indo-U.S. Technical Co-operation Programme, five Land Grant Colleges of USA have agreed to assist Indian institutions engaged in agricultural education and research by way of laboratory equipment, library books and exchange of staff personnel. The arrangements provide for assistance in the following directions :

(*i*) Deputation of 42 experienced staff members from the American Universities for teaching and research work in India.

(*ii*) Fellowships for Indian staff members for advanced training in selected subjects in USA. Provision was made for 35 fellowships under the 1956 programme and 45 fellowships under the 1957 programme. A further provision for 68 fellowships has been made under the 1958 programme.

(*iii*) Class-room, laboratory and field equipment including technical books and journals and periodicals not ordinarily available in India. Funds committee up to March, 1957 were about $ 1·6 million. Further funds to the extent of $3,65,000 have been committed under the 1958 programme.

During the year under report, on an average 25 American University staff members worked in agricultural and veterinary colleges in India, under the above programme. Since the beginning of the programme up to June, 1958, 64 Indian staff members had been sent for advanced training in USA, 28 of whom have already returned to India after completion of their training.

Equipment and books to the extent of $1,15,000 had already been received in India up to March, 1958 and supplied to the various participating institutions. The balance equipment and books are in the various stages of procurement.

### AGRICULTURAL EXTENSION ADVISORY COMMITTEE

With a view to promote Agricultural and Animal Husbandry programme in the Community Project and National Extension Service Blocks, an Agricultural Extension Advisory Committee was constituted in 1954, with the Agricultural Commissioner with the Government of India as its Chairman and Shri D.N. Singh, Deputy Agricultural Extension Commissioner, Directorate of Extension and Training, as its Secretary. The main functions of this Committee are :

(*a*) to collect, collate, compile and sift information regarding the results of researches achieved so far and those that may be achieved in future under the auspices of the Central and State Governments, the Indian Council of Agricultural Research, the Central Commodity Committees, etc.

(*b*) to make recommendations regarding the demonstration of results of researches of economic value on the cultivators' fields, and

(*c*) to make recommendations to the Central and State Governments for the propagation throughout the country of the results of proved economic value already tried and demonstrated to the satisfaction of the farmers.

Since its inception the Committee has been preparing for the use of Extension, Workers, detailed notes (State-wise as well as region-wise) on the major crops cultivated in India. During the year 1957-58, 57 comprehensive notes on rice and 44 notes on wheat were compiled and passed on to the Ministry of Community Development for distribution to the Extension Officers in the National Extension Service Blocks and District Agricultural Officers in the States for guidance. The work of compiling notes on the animal husbandry side on cattle, buffaloes, sheep and goats has also been taken up by the Committee.

## THE RAFI AHMED KIDWAI MEMORIAL PRIZES FOR AGRICULTURAL RESEARCH

With a view to creating an incentive for research workers and to recognising outstanding research work done by them in the fields of agriculture, animal husbandry and allied subjects, the Governing Body of the I.C.A.R. decided at its meeting held in February, 1956 to institute eleven prizes, of the value of Rs. 5,000 each, known as the "Rafi Ahmed Kidwai Memorial Prizes for Agricultural Research" in each of the following subjects, (*i*). Agronomy, (*ii*). Agricultural Engineering, (*iii*). Agricultural Chemistry, (*iv*). Agricultural Botany, (*v*). Agricultural Zoology (including Fisheries), (*vi*). Horticulture, (*vii*). Animal Breeding, (*viii*). Animal diseases, (*ix*). Dairying, and (*x*). Agricultural and Animal Husbandry Economics and Statistics.

In pursuance of this decision applications have been invited from the research workers for award of the prizes in the year 1958 on the basis of results achieved on outstanding research work done either individually or jointly during the calendar year 1957 i.e. from 1st January to 31st December, 1957.

CHAPTER VI

## PUBLICATIONS AND PUBLICITY

### PUBLICATIONS

**Scientific Journals**—The Council's Scientific Journals, viz. the Indian *Journal of Agricultural Science* and the *Indian Journal of Veterinary Science and Animal Husbandry* were published regularly.

**Statistical Newsletter**—This quarterly bulletin which reports the activities of the statistical wing of the Council and other items of interest to the statisticians was published regularly. Popular articles contributed by statisticians continued to be published which contain useful information for agricultural workers. The bulletin was distributed widely both in India and abroad.

**Horticultural Abstracts**—This monthly periodical contains abstracts, summaries and extracts from various journals, annual reports, bulletins, circulars and books, etc. published in India and abroad on horticulture. The main object of the bulletin is to keep the research workers in the country informed with the latest developments in the sphere of horticultural research in India and abroad. The periodical was published regularly and its get-up has been improved.

**Scientific Bulletins**—The following scientific bulletins were published during the period under report :

Revised list of Common names of Indian Plant diseases by R.S. Vasudeva.

Nutritive Value of Indian Cattle Foods and Feeding of Animals by K.C. Sen.

Final Report of All India Soil Survey Scheme by K.C. Sen.

**Research and Review Series**—The publications in this Research and Review Series contain useful information on agricultural and animal husbandry subjects based on results of researches carried out in the country. The following publications were published during the year under report:

1. Soil Testing Kits by S.P. Raychaudhary and B.V. Subbiah.
2. Preparation of Fuel Gas and Manure by Anaerobic fermentation of organic materials, by C.N. Acharya.
3. Foot and Mouth Disease in India by M.R. Dhanda and V.R. Gopalkrishna.
4. Camels and their Management by P.N. Nanda.
5. Livestock Products. By H.S. Bawa.
6. Diagnosis of Tuberculosis in Animals by J.M. Lall.
7. Contagious Caprine Pleuro Pneumonia by P.R. Krishna Iyer.
8. Fisheries and Fishing Industry in India By B.N. Chopra.
9. Establishment and Operation of the Farm by Arjan Singh.

10. Farm Management Extension and Research By Arjan Singh.

11. Banana in India By T. Gopalan Nair.

12. Soils of India By S.P. Raychaudhari.

13. Incidence of Anaerobic Infections in Sheep By M.R. Dhanda and C. L. Sharma.

**Miscellaneous Publications**—1. Grassland and Fodder Resource in India By Dr. R.O. Whyte.

2. Agricultural Research In India, Institutes and Organisation By M.S. Randhawa.

Subsidies—The Council continued to give financial assistance to scientific societies which published scientific journals with a view to promoting and disseminating scientific knowledge. This scheme has been of great help in the continuance of the number of scientific journals which would have otherwise ceased publication owing to financial difficulties.

Exchange of Publications—The Council had established exchange relations with scientific institutions all over the world.

The Council received foreign journals and reports of other miscellaneous publications in exchange for its own publications. The exchange of publications is undertaken on an equitable basis. The literature received from abroad proved valuable addition to the Council's Library and useful to the technical personnel.

**Indian Farming** –Indian Farming was published regularly. Improvements in get-up and contents were maintained. Some new features were also introduced.

**Kheti**—Kheti was published regularly. The get-up and contents of the journal were further improved.

**Farm bulletins** –The following farm bulletins were issued:

| *English* | *Hindi* |
|---|---|
| 1. The Breadfruit in India | 1. Cashewnut Cultivation in India |
| 2. Banana in India | 2. Cotton Cultivation |
| 3. Fish Culture in India | 3. Grape Culture in India |
| 4. The Key Village Scheme | 1. Ghar-Ke-Bagiche-Ki-Roop-Rekha |
| 5. Krishi Pandits | 5. Vriksha Rapan aur Dekhbhal |
| 6. Guava in India | 6. Rashhiya Upran |
| 7. The Papaya in India | 7. Ber in India |
| 8. The Pineapple in India | 8. Krishi Pandits |
| 9. Wheat Cultivation in India | 9. Vana Mahotsava |
| 10. The Phalsa in India | 10. Bee-Keeping in India |
| 11. Grassland and its Management | 11. The Phalsa in India |
| 12. Soil Fertility and How to maintain it. | 12. The Pineapple in India |
| 13. Breeds of Cattle in India | 13. The Jack-Fruit in India |
| 14. The Mangosteen in India | 14. The Guava in India |

| *English* | *Hindi* |
|---|---|
| 15. The Jack-Fruit in India | 15 The Papaya in India |
| 16. The Loquat in India | 16. Aonla, Mulberry & Karonda |
| 17. Mixed Farming | |
| 18. Aonla Mulberry and Karonda in India. | |
| 19. Tips on Better Farming | |
| 20. Home Preservation of Fruits | |
| 21. Vegetable Cultivation in North India | |
| 22. Sericulture in India | |
| 23. Sugarcane in Peninsular India | |

Punjabi versions of a number of Farm Bulletins have been issued. Work is in progress for issuing Tamil, Telugu and other language versions of Farm Bulletins.

**Dharti Ke Lal**—Dharti ke Lal was published regularly. Copies of journal were also supplied to the Community Development Ministry for distribution to N.E.S. and C.D. Blocks.

**Indian Horticulture**—Indian Horticulture was published regularly and improvements as regards get-up and contents were maintained.

**Farm News Releases**—Farm news releases on farm practices were issued regularly every week. The pamphlet 'Tips on Better Farming No. 2' containing a number of Farm News Releases was issued for the use of the farmers and Village Level Workers.

**Leaflets and Pamphlets**—The following leaflets and pamphlets were issued by the Council during 1957-58 :

| | |
|---|---|
| 1. Agricultural Demonstration Centres | (English) |
| 2. Sea-Island 'Andrews' Cotton | (English) |
| 3. Feeding Poultry | (English) |
| 4. Pests and Diseases of Coconut | (English) |
| 5. Controlling Pohli | (English) |
| 6. How to Grow Coconut | (English) |
| 7. Controlling ox-warble fly | (Hindi) |
| 8. Grow More Cashewnuts | (English) |
| 9. Earth-Moving Equipment for Border-Strip Irrigation | (English) |
| 10. How to prepare land for Border-Strip Irrigation | (English) |
| 11. How to know : When to Irrigate when to Stop. | (English) |
| 12. Cashewnut | (English) |
| 13. Mango | (English) |
| 14. Line Sowing | (English) |
| 15. Papaya Cultivation | (English) |

A folder entitled 'Guide for Punjab Farmers' was also published during the year.

**Books**—The following books were published during the year under report. (*i*) Mango in India and (*ii*) Mechanical Cultivation in India.

### SALE OF PUBLICATIONS

The activities of the Council in respect of distribution and sale of publications on agriculture, animal husbandry and allied subjects increased considerably during the period under report. The number of copies of publications supplied to the N.E.S./C.D. Blocks during the year was 21,151,566 as against 5,40,131 supplied during the previous year. The total sales during the year amount to Rs. 8,20,000 as compared to Rs 1,89,778 during 1956-57. The total advertisement revenue during the year under report, was Rs. 71,146.

### PUBLICITY

**Agricultural Information Production and Training**—The Indian Council of Agricultural Research has undertaken a vastly expanded programme of agricultural information, production and training at the Centre as well as in the States. The Council continued to provide during the year under report necessary assistance for the strengthening of the Agricultural Information Units in the States.

The Council organised during May-June 1957, a six weeks Agricultural Information Training Course for training the States' personnel and the publicity staff from the various Commodity Committees, in the art of preparation and utilisation of agricultural information material. The Council also organised during the year three agricultural information workshops in the States.

**Supply of Literature to Village Level Workers**—With a view to ensuring that the Village level workers and the supervisory staff of the National Extension Service Blocks, are constantly fed with agricultural information required for keeping them abreast of the day-to-day developments in the fields of agriculture, animal husbandry and allied subjects, the Council supplied during the year under report, agricultural information literature worth about Rs. 6,60,000 to the National Extension Service Blocks.

**T.C.M. Assistance for Information Programme**—For the effective use of the printing units procured under the Indo-U.S. Technical Cooperation Programme, during 1954-55 and supplied to the various States for the Production of agricultural information literature and audiovisual aids, further supplies of multilith and photographic materials worth about Rs. 1,86,000 were obtained through the T.C.M. and distributed to the States during the year.

### EXHIBITIONS

The year 1957-58 was the third year of the operation of the Exhibition Scheme. The Scheme aims at popularising improved farming practices in the villages through the effective use of exhibits and other visual aids. Teaching through seeing has been found to be very effective in India where the bulk of the farming population cannot read and write.

Farmers have shown great interest in the Council's exhibitions, which are so designed as to give useful information in the simplest form possible.

During the year under report, the Council organised 12 exhibitions in the country, thus bringing the average of one exhibition each month. Details are given below:

1. Exhibition organised in conjunction with the Fourth Extension and Training Conference at Mount Abu (Rajasthan).

2. Exhibition organised in conjunction with the State Cattle Fair at Julana (Punjab).
3. Exhibition organised in connection with the F.A.O. Development Centre on Farm Planning and Management for India and Far East in Vigyan Bhawan, New Delhi.
4. Development and Industrial Exhibition at Jaipur (Rajasthan).
5. Agricultural Exhibition and Cattle Fair, Etawah, U.P.
6. Agricultural Development Exhibition at Mathura, U.P.
7. Exhibition organised in conjunction with the Indian Road Congress Convention at New Delhi.
8. Exhibition organised by the All-India Khadi & Village Industries at Gauhati, Assam, in conjunction with the Annual Session of the All-India Congress.
9. Exhibition organised by the Indo-China Friendship Association, Bombay.
10. Agricultural Exhibition and State Cattle Show, Meerut (U.P.).
11. Exhibition held on the occasion of the All-India Cattle Show at Rajghat, Delhi.
12. Exhibition held in conjunction with the Annual Convention of the Farmers' Forum of India at Talkatora Gardens, New Delhi.

The Council received invitations from foreign countries which had to be declined owing to the difficult foreign exchange position.

However, the Council's exhibits were displayed in the wholly Indian exhibition held at Peking in October, 1957 under the auspices of the Ministry of Commerce and Industry.

Agricultural Films—The Indian Council of Agricultural Research has set up a film production unit in cooperation with the Ministry of Information and Broadcasting for the production of agricultural instructional films. The production of about 10 films was planned during the year; these are now in the various stages of production. These films will serve as instructional films for farmers, extension workers and research workers.

Farm Radio Publicity Unit—With a view to improving and making more effective the rural programmes of the All-India Radio, a Farm Radio publicity unit has been established in the Indian Council of Agricultural Research. The main functions of this unit are :

(*i*) to maintain a close liaison between the Indian Council of Agricultural Research, the Central Research Institutes, State Agricultural and Animal Husbandry Departments, Central Commodity Committees and the All-India Radio Stations.

(*ii*) to guide the activities of the Agricultural information units in the States in the fields of radio publicity.

(*iii*) to plan agricultural broadcasts in collaboration with the All-India Radio.

CHAPTER VII

## LIBRARY

The work done by the Indian Council of Agricultural Research Library during the year April, 1957 to March, 1958 is presented below under the following heads : acquisition section, service section, reorganization of the library, library staff, library statistics.

**Acquisition**—The number of publications added during the year was 684. These have been classified and catalogued. Eight library lists of additions were prepared and circulated to officers. This covered a total of 578 entries. The number of catalogue cards prepared is more than 4,500. About 800 sets of periodicals were received in the library. Of these about 100 were subscribed for and the rest were mostly received on exchange basis, while a few were received as gifts.

Current issues of periodicals numbering 6,953 and newspapers numbering 6,537 were received and registered; 900 volumes mostly of periodicals were got bound.

**Service Section Circulation**—Select issues of periodicals numbering approximately 5,200 were displayed in the reading room periodical racks and about 388 were circulated to advisers and other officers. During the year 1957-58, select bibliographical lists were prepared; these were eight in number and were circulated to various agriculture and veterinary colleges as well as to the officers and sections of the Council and to the officers of some other Ministries.

**Loans**—There has been a considerable increase in loan service. The total number of loan transactions during the year was 4,627 including Branch Library (Statistical Wing) as against 3,718 during the previous year.

**Consultation**—The use of the library has increased considerably. The readers register has recorded the visit of 5,862 readers during the year as against 4,148 of previous year. About 19,000 publications were consulted by them as against 10,500 of previous year.

Requests from various sources are coming in for allowing persons to consult the library for their work. For example, requests on behalf of the following persons were received and they were allowed consultation of publications in the Library; Research Scholar, Nagpur University; Shri Tarlok Singh, Research Student, Punjab University; Research Asst., Delhi School of Economics; Research Student, Allahabad University; Veterinary Asst. Surgeon, Najafgarh; Post-Graduate Student of I.A.R.I. and Research Asst., Saugor University.

**Bibliographic Service**—Besides a large number of routine questions, long range reference questions were handled at the library. These involved searches and compilation of 29 bibliographies on a number of subjects covering a total of 789 references and 62 typed pages.

Besides the officers of the Council, I.A.R.I. and Ministries of the Union Government at Delhi, the reference service was extended to (*i*) Director, Department of Agriculture, Japan, (*ii*) Mr. Raabe of the University of California, (*iii*) In-charge, Chemistry of Fermentation Products Unit, Illinois,

(*iv*) Pakistan Central Cotton Committee, Karachi, (*v*) Dr. A. Latif, Chemistry Department, Cairo University, Egypt, (*vi*) Mr. M.B. Saxena, Bhopal, (*vii*) Head of Division, Parasitology, I.V.R.I., Izatnagar, (*viii*) Messrs. New Book Depot, New Delhi, (*ix*) Mrs. S. Narayan, Jaipur, (*x*) Post-Graduate Department of Economics, University of Jammu & Kashmir and (*xi*) Demographic Research Centre, Delhi School of Economics, Delhi-8. Some selected bibliographies on agriculture, animal husbandry and allied subjects were prepared and circulated to various agriculture and animal husbandry colleges for selection of their requirements.

**Press Cutting Service**—About 800 press cuttings were prepared during the year. But due to some difficulty or other, these could not be circulated to the advisers and experts of the Council.

**Reorganization of the Library**—On the basis of the report submitted by Dr. R. R. Shaw of U.S.A., some unwanted publications were weeded out and sent to other libraries which required them. Libraries who took these publications are Delhi School of Economics, I.V.R.I., N.D.R.I., I.A.R.I., Agriculture College, Ludhiana and Director General Health Services, New Delhi.

**Organization of a Branch Library at the Statistical Wing**—The Branch Library at the Statistical Wing is for immediate service to the officers and students in the Statistical Branch. To improve the service, duplicate sets of books and periodicals specially weeded have been purchased. It has been decided to purchase reprints of articles written by staff members of the Statistical Wing for distribution to various parties, so that reprints of articles in exchange may be got from them. The Council has received 140 such items from various parties.

**Library Statistics**

Books and publications added : 684
Current periodical issues received : 6,953
Newspapers received : 6,537
Press Cutting Service : 800
Number of Loan Transactions : 4,627
Consultation Service : 19,000
Number of Publications classified : 600
Number of catalogue cards prepared : (more than) 4,500
Number of readers : 5,862
Number of reports received : 293
Number of bulletins, pamphlets etc. received : 3,500

APPENDIX I

**Schemes, the Continuance of which was Sanctioned**

| Item No. | Name of the Scheme | Sponsoring Authority |
|---|---|---|
| 1 | Improvement of Pulses (Revised Scheme): Additional Grant .. .. | Assam |
| 2 | Botanical survey and collection of breeding material of paddy .. .. | C.R.R.I., Cuttack |
| 3 | Breeding piricularia resistant strains of paddy .. .. | Madras |
| 4 | Multiplication and distribution of Hybrid *Bajra* .. .. | Bombay |
| 5 | Co-ordinated Maize Breeding Scheme .. | I.C.A.R. |
| 6 | Physiology of rice plant in relation to nutrient deficiency .. .. | Calcutta University |
| 7 | Synthetic plant hormones .. .. | Bombay |
| 8 | Pulses improvement .. .. | Madhya Pradesh |
| 9 | Improvement of fodders and legumes .. | Madras |
| 10 | Improvement of pasture lands .. .. | I.A.R.I. |
| 11 | Improvement of pastures, grasses and legumes .. .. | Bombay |
| 12 | Rice Stem borer .. .. | Madras |
| 13 | Rice Stem borer .. .. | Andhra Pradesh |
| 14 | Rice Stem borer .. .. | Andhra Pradesh (Hyderabad) |
| 15 | Rice Stem borer .. .. | West Bengal |
| 16 | Stem rot disease of rice .. .. | Madras |
| 17 | Co-ordination of Agricultural research .. | I.C.A.R. |
| 18 | Citrus rootstock trials .. .. | Andhra Pradesh |
| 19 | Cytogenetical investigations on fruit trees | Calcutta University, Calcutta |
| 20 | Coordinated schemes for the preservation and storage of fruits and vegetables .. | CFTRI, Mysore, Kulu (Pb.) & Gauhati (Assam) |
| 21 | Citrus Fruit Research .. .. | Orissa |
| 22 | Orange Research .. .. | Mysore (Coorg) |
| 23 | Investigation of fruit pests .. .. | Andhra Pradesh |
| 24 | Citrus-die-back .. .. | I.A.R.I. |
| 25 | Diseases of guava .. .. | Rajasthan (Ajmer) |
| 26 | Citrus-die-back (Additional grant for laboratory extension) .. .. .. | Mysore (Coorg) |
| 27 | Onion Research—Additional staff for the inclusion of research work on storage of Onions .. .. | Andhra Pradesh |

APPENDIX I—*contd.*

| Item No. | Name of the Scheme | Sponsoring Authority |
|---|---|---|
| 28 | Improvement of Vegetables .. .. | West Bengal |
| 29 | Research on Miscellaneous tuber crops and related plants .. .. | Kerala |
| 30 | Medicinal Plants .. .. | Assam |
| 31 | Termite research .. .. | F.R.I., Dehradun |
| 32 | Studies on Indian spices .. .. | Calcutta University |
| 33 | Collection of soil data in India, 1945-56 .. | I.A.R.I. |
| 34 | Synthetic Polyelectrolytes as soil conditioners .. .. .. | West Bengal |
| 35 | Study of composition of plants growing on *Usar* lands under reclamation .. .. | Lucknow University |
| 36 | Photo-chemical nitrogen fixation in soils—Sheila Dhar Institute of Soil Science .. | Allahabad University |
| 37 | Schemes on *Usar* land reclamation at Sheila Dhar Institute of Soil Science .. | Allahabad University |
| 38 | Immunogenetics of Indian cattle .. | I.V.R.I. |
| 39 | Physiological genetics of different breeds of cattle .. .. | West Bengal |
| 40 | Selective breeding *Vs.* grading up—Ghumsur | Orissa |
| 41 | Using milch cows for work .. .. | I.V.R.I. |
| 42 | Sheep Research Station .. .. | Hissar |
| 43 | Sheep breeding on regional basis .. | Madras (Nilgiris) |
| 44 | Sheep breeding on regional basis .. | Bihar (Patna) |
| 45 | Angora Goat Breeding .. .. | Uttar Pradesh |
| 46 | Duck breeding (Additional grants) .. | Kerala |
| 47 | Chick hatchery processing plant .. | Madras (Katpadi) |
| 48 | Raising 20,000 White leghorn chickens for distribution .. .. | Madras |
| 49 | Survey of bacteriological quality of milk produced in Kaira District—Additional funds | Bombay |
| 50 | Investigations on shelf life of ghee—Additional funds .. .. | N.D.R.I. |
| 51 | Metabolic effects of hormones in relation to induced lactation and induction of sterility in scrub cows .. .. | Uttar Pradesh |
| 52 | Establishment of bee-keeping research station .. .. | Madras (Coimbatore) |
| 53 | Animal Nutrition Scheme .. .. | Mysore (Bangalore) |
| 54 | Eastern Regional Animal Nutrition Research Centre .. .. | West Bengal (Haringhata) |
| 55 | Study on the value of urea as a protein substitute in the rations of cows and buffaloes for growth and milk production .. | I.V.R.I. |

APPENDIX I—*contd.*

| Item No. | Name of the Scheme | Sponsoring Authority |
|---|---|---|
| 56 | Studies on the influence of trace elements on the health and productive capacity of Livestock in India .. .. | I.V.R.I. |
| 57 | Regional animal nutrition stations—Additional staff. | Anand, Bangalore and Haringhata. |
| 58 | Control of mainfluke diseases of bovines with special reference to Nasal Schistosomiasis | Mysore |
| 59 | Control of parasitic diseases with special reference to liverfluke disease .. .. | Mysore |
| 60 | Investigation on lumber paralysis in goats | Orissa |
| 61 | Study of the bacterial contents of tubular genitalia of the bovines and the investigation into the causes of detention of placenta in bovines .. .. | Orissa |
| 62 | Disease Investigation Officer .. .. | Mysore |
| 63 | Assistant Disease Investigation Officer (Poultry) .. .. | Andhra Pradesh |
| 64 | Investigation of Mastitis .. .. | Uttar Pradesh |
| 65 | Investigation of Mastitis .. .. | I.V.R.I. |
| 66 | Improvement in the technique and methods used in the manufacture of virus vaccines | Madras |
| 67 | Improvement in H.S. Vaccine and manufacture of combined vaccine for H.S. and B.Q. | Madras |
| 68 | Bearing of nutrition or helminthic infections in animals .. .. | I.V.R.I. |
| 69 | Coccidiosis in poultry .. .. | I.V.R.I. |
| 70 | Control and eradication of humpsore .. | West Bengal |
| 70-A | Hydrobiological and faunistic survey of Godavari Estuarine system—additional funds .. .. | Andhra University. Scheme commences w.e.f. 1-4-58. |
| 71 | Indian Council of Agricultural Education | I.C.A.R. |
| 72 | Supply of Agricultural Information Literature to the N.E.S. Blocks .. .. | I.C.A.R. |
| 73 | Publication of a monthly Hindi Journal "KHETI" .. .. | I.C.A.R. |
| 74 | Bringing out publications of the I.C.A.R. in regional languages .. .. | I.C.A.R. |
| 75 | Publication of quarterly popular journal "INDIAN HORTICULTURE" .. | I.C.A.R. |

APPENDIX I—*concld.*

| Item No. | Name of the Scheme | Sponsoring Authority |
|---|---|---|
| 76 | 'Integrated Publicity Work' (Publicity Fund) | I.C.A.R. |
| 77 | Publication of a book "Flowering Trees in India" (Additional Funds) .. .. | I.C.A.R. |
| 78 | Publication of Crop Calendars, Crop Diaries, Charts and Plant Diseases, etc. .. | I.C.A.R. |
| 79 | Preparation of a monograph on 'Mango' (Additional Funds) .. .. | I.C.A.R. |
| 80 | Preparation of a book on 'Horticulture' (Additional Funds) .. .. | I.C.A.R. |
| 81 | Publication of 'Rice News Teller' (Additional Funds) .. .. | I.C.A.R. |
| 82 | Setting up of a Film Production Unit in the I.C.A.R. .. .. | I.C.A.R. |
| 83 | Distribution of Publications .. .. | I.C.A.R. |
| 84 | Printing of the quarterly journal, 'Statistical News Letter' .. .. | I.C.A.R. |
| 85 | Publication of Monograph entitled "Rice in India" (2nd Edition) .. .. | I.C.A.R. |
| 86 | Award of Fellowships to Diploma Course Students in Agriculture Statistics .. | I.C.A.R. |
| 87 | Further investigations into the problems of sampling of fleeces for assessing wool quality. Provision for the additional Staff | I.C.A.R. |
| 88 | Assessing the cost of cultivation of cotton and rotation crops in principal growing regions in India (Additional Funds) .. .. | I.C.C.C. (Bombay) |
| 89 | Creation of additional two senior and two junior Research Fellowships in Plant Physiology under the scheme for the award of Research Fellowships in various branches of Agricultural Science .. .. | |

APPENDIX II

**New Schemes Sanctioned**

1 Evolution of paddy strain for inundated areas, Madras
2 Evolving improved varieties of rice, Kerala
3 Project for intensification of regional research on Cotton, Oilseeds & Millets, I.C.A.R.
4 Investigations on the pests of pulses in Gujerat, Bombay
5 Investigation of false smut, leaf blight and Ephelis disease of paddy, Andhra Pradesh
6 Improvement and stabilisation of off-season bearing of mango in Kanyakumari, Madras
7 Banana Research Scheme, Kerala
8 Research on Pine-apple, Trichur, Kerala
9 Establishment of betelvine research station in Cuddapah, Andhra Pradesh
10 Cultivation of medicinal plants in Cinchona Plantation, Madras
11 Cultivation of Camphor in Wynad, Kerala, Shri P. B. Kurup (Kerala)
12 Donation of cups in flower shows in different regions, I.C.A.R.
13 Research on and development of vanilla cultivation in Wynad, Kerala
14 Deputation of an officer to South-East Asian Countries, Kerala
15 Research on turmeric, ginger and elephant foot, Punjab
16 Research on ginger in Himalayan areas, West Bengal
17 Appointment of Research Assistants for Salinity Research, B. R. College, Agra
18 Intensified supervision and coordination of schemes on cattle breeding, I.C.A.R.
19 Award of fellowship in Animal Husbandry subjects, I.C.A.R.
20 Disease Investigation Officer (Camel), Punjab Veterinary College, Punjab
21 Disease investigation, Himachal Pradesh
22 Manufacture of concentrated milk, Bombay
23 Research unit for study of sheep Production in mixed farming in Madras
24 Goat improvement in Mohari Production, Himachal Pradesh
25 Sterilization of Milk Cream, Bombay
26 Training in Meat Technology Production, I.C.A.R.
27 Cheap Poultry Houses, Madras
28 Cheap Poultry Houses, Bihar
29 Cheap Poultry Houses, Orissa
30 Cheap Poultry Houses, Uttar Pradesh
31 Promotion of Research in Paddy-cum-Pisciculture in Krishna District, Andhra Pradesh

APPENDIX II—*contd.*

32 Establishment of bee-keeping centre for Northern Region, Himachal Pradesh

33 Determination of economics of poultry ration, Uttar Pradesh

34 Determination of economics of poultry ration, Mysore

35 Preparation of text-books on Entomology and Soil Science for students in agricultural colleges, I.C.A.R.

36 Publication of a book entitled 'Agriculture and Animal Husbandry in India', I.C.A.R.

37 Publication of 'Potato Journal', I.C.A.R.

38 Preparation of a book on 'Flowering Annuals' by Shri L. Desai, I.C.A.R.

39 Handbook on 'Indian Grammineae', I.C.A.R.

40 Preparation of indices of the Scientific Journals of the I.C.A.R. *viz.* 'Indian Journal of Vet. Science' and 'Indian Journal of Agriculture Science'

41 Preparation of a series of monographs on Animal Husbandry subjects I.C.A.R.

42 Preparation of a book on 'Tuberous and Bulbous Plants'

43 Supply of certain special I.C.A.R. publications at subsidized rates

44 Award of Gold Medals to two Statistical Students, I.C.A.R.

45 Maintenance of building, I.C.A.R. Statistical Wing, I.C.A.R.

46 Study of Economics of Bunding, Bombay

47 Study of economics and social conditions of the people of the Ghataprabha left bank canal areas before the introduction of canal irrigation, Agricultural College, Dharwar, Bombay

48 Study of production and consumption aspects of agricultural families in different class structure in Anand area of Middle Gujerat, Institute of Agriculture, Anand, Bombay

49 A pilot scheme for study of cultivation practices and yield of mango crop, I.C.A.R. (Scheme to be run in Uttar Pradesh)

50 A pilot scheme for Maintaining Research Project files, I.C.A.R. (Headquarters)

51 Formation of an *ad hoc* Committee under the I.C.A.R. Rice Committee

52 Study of Comparative value of grading of Sahiwal and cross-breeding with Jersey Bulls at Bhadri Farm, U.P.

53 Scheme for the promotion of research in paddy-cum-pisciculture in Krishna District

APPENDIX III

**Schemes which terminated in 1956-57**

1 Improvement of hill paddy, Assam
2 Study on paddy agromyzed fly, Andhra Pradesh
3 Breeding salt and flood resistant varieties of paddy, Kerala
4 Horticulture, Bombay
5 Proposal for obtaining an Italian expert on horticulture, I.C.A.R.
6 Horticulture investigations, Chaubattia, Uttar Pradesh
7 Remedial measures against San-Jose scale, Kashmir
8 Spices & cashewnuts, I.C.A.R.
9 Pests and diseases of cashewnut plantation, Mysore
10 Rapid soil test, I.A.R.I.
11 Soil and plant growth, Agra
12 Experiment on Kotaka and dicalcium phosphate, I.C.A.R.
13 Green manuring crops, C.R.R.I.
14 Green manuring crops, Himachal Pradesh
15 Green manuring crops, I.C.J.C.
16 Studies on microflora of soils, I. I. Sc., Bangalore
17 Use of phytohormones for higher yields, Bombay
18 Development of herbarium cryptogenial orientals, I.A.R.I.
19 Artificial insemination, I.D.R.I.
20 Metabolic effects of hormones in relation to induced lactations, Uttar Pradesh
21 Detection of adulteration and estimation of main constituents of milk, Punjab University
22 Pathogenic bacteria, I.D.R.I.
23 Preparation of sanitizegs, I.D.R.I.
24 Wool analysis, Bihar
25 Processing of unpopular fish, West Bengal
26 Award of fellowship in dairying
27 Post-graduate course in parasitology, Madras
28 Survey of indigenous implements, I.A.R.I.
29 Survey of indigenous implements, I.C.A.R.
30 Method and practice of farm accounts, Gokhale Institute
31 Duplication section, I.C.A.R.
32 Egg laying trials scheme, I.V.R.I.

M/P31CAR—10

APPENDIX IV

**List of Members of the Indian Council of Agriculture Society as on the 7th March 1958**

1 Shri Ajit Prasad Jain, Minister for Food & Agriculture, Government of India, New Delhi (President)

2 Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi

3 Shri M. V. Krishnappa, Deputy Minister for Agriculture, Government of India, New Delhi

4 Shri P. Thimma Reddy, Minister in charge of Agriculture, Animal Husbandry, Forest and Fisheries, Government of Andhra Pradesh, Hyderabad-Deccan

5 Shri Moinul Haque Chaudhury, Minister in charge of Agriculture (including Food Production), Veterinary, Animal Husbandry and Pisciculture, Government of Assam, Shillong

6 Shri Vasant Phulsing Naik, Minister for Agriculture (including Veterinary & Animal Husbandry) and Aarey Milk Colony, Government of Bombay, Sachivalaya, Bombay

7 Shri C. Achutha Menon, Minister for Finance and Agriculture, Government of Kerala, Trivandrum

8 Shri Takhat Mal Jain, Minister for Industries and in charge of Agriculture (including Veterinary and Animal Husbandry), Government of Madhya Pradesh, Bhopal

9 Shri M. Bhaktavatasalam, Home Minister in charge of Agriculture & Animal Husbandry, Government of Madras, Fort St. George, Madras

10 Shri H. S. Rudrappa, Minister for Agriculture & Forests, Government of Mysore, Mysore Govt. Secretariat, Vidhan Soudha, Bangalore

11 Shri Vir Chand Patel, Minister in charge of Agriculture, Government of Bihar, Patna

12 Shri Radha Nath Rath, Minister in charge of Agriculture, Government of Orissa, Cuttack

13 Shri Gurbanta Singh, Development Minister in charge of Agriculture, Government of Punjab, Chandigarh

14 Shri Nathu Ram Mirdha, Minister in charge of Agriculture, Government of Rajasthan, Jaipur

15 Shri Hukam Singh Visen, Minister in charge of Agriculture, Government of Uttar Pradesh, Lucknow

16 Dr. R. Ahmed, Minister in charge of Agriculture, Animal Husbandry and Forests, Government of West Bengal, Calcutta

17 Shri Abdul Gani Tarli, Minister in charge of Agriculture, Government of Jammu & Kashmir, Srinagar/Jammu Tawi

18 Shri A. D. Pandit, I.C.S., Chief Commissioner of Delhi, Delhi

19 Shri P. C. Mathew, I.C.S., Chief Commissioner of Manipur, Imphal

20 Shri Bajraug Bahadur Singh, Lt. Governor of Himachal Pradesh, Simla

APPENDIX IV—*contd.*

21 Shri K. P. Bhargava, I.C.S., Chief Commissioner of Tripura, Agartala

22 Shri T. G. Ayyar, I.C.S., Chief Commissioner of Andaman and Nicobar Islands, Port Blair

23 Shri S. Moni, Administrator, Laccadives, Minicoy & Amindivi Islands, Kozhikode-4

24 Shri Rai Prithvi Raj, Director of Agriculture, Andhra Pradesh, Hyderabad-Deccan

25 Shri L. K. Hardique, Director of Agriculture, Assam, Shillong

26 Shri B. P. Akhaury, Director of Agriculture, Bihar, Patna

27 Shri S. P. Mohite, I.A.S., Director of Agriculture, Bombay State, Poona

28 Shri S. S. Apte, Director of Agriculture, Madhya Pradesh, Rewa

29 Shri P. D. Nair, Director of Agriculture, Kerala, Trivandrum

30 Shri A. Venhateson, I.A.S., Director of Agriculture, Madras State, Madras

31 Shri M. Mallaraj Urs, Director of Agriculture, Mysore State, Bangalore

32 Shri G. C. Dash, I.A.S., Director of Agriculture & Food Production, Orissa, Cuttack

33 Dr. Arjan Singh, Director of Agriculture, Punjab, Simla

34 Shri Samrath Raj, Director of Agriculture & Food Production, Rajasthan, Jaipur

35 Shri Ram Surat Singh, Director of Agriculture, Uttar Pradesh, Lucknow

36 Dr. H. K. Nandi, Director of Agriculture, West Bengal, Calcutta

37 Shri G. M. Butt, Director of Agriculture, Jammu & Kashmir, Srinagar Jammu Tawi

38 Shri N. Bhagwandas, I.A.S., Director of Animal Husbandry, Andhra Pradesh, Hyderabad-Dn.

39 Shri M. L. Malik, Director of Animal Husbandry, Veterinary Department, Assam, Shillong

40 Shri S. K. Sen, Director of Animal Husbandry, Bihar, Patna

41 Shri S. R. Chadha, Director of Animal Husbandry, Bombay State, Poona

42 Shri G. C. Juneja, Director of Veterinary Services, Madhya Pradesh, Rewa

43 Shri B. N. Hande, Director of Veterinary Services and Animal Husbandry Rajasthan, Jaipur

44 Shri V. K. Madhava Menon, Director of Animal Husbandry, Kerala State, Trivandrum

45 Shri D. Pattabiraman, Director of Animal Husbandry, Madras State, Madras

APPENDIX IV—*contd.*

46 Shri Gurbachan Singh, Director of Animal Husbandry & Veterinary Services, Orissa, Cuttack

47 Shri K. S. Shetty, Director of Animal Husbandry & Veterinary Services, Mysore State, Bangalore

48 Shri Mohan Singh Malhi, Director of Veterinary Services and Warden of Fisheries, Punjab, Simla

49 Dr. P. G. Pande, Director of Animal Husbandry, U. P., Lucknow

50 Director, Veterinary Services & Animal Husbandry, West Bengal, Calcutta

51 Major J. M. Lahiri Director of Veterinary Services, Jammu & Kashmir, Srinagar/Jammu Tawi

52 Shri P. N. Thapar, I.C.S., Secretary to the Government of India, Ministry of Agriculture (Department of Agriculture) New Delhi

53 Shri Beni Prasad Agarwal, Member Rajya Sabha, 119-A, Mukta Ram Babu Street, Calcutta or 7/12-C, South Avenue, New Delhi

54 Shri K. Madhava Menon, Member Rajya Sabha, Padmalayam, Kozhikode, Malabar, Kerala State or 71, North Avenue New Delhi

55 Shri T. Sanganna, Member Lok Sabha, Rayaguda P. O. Rayaguda/ Distt. Koraput, Orissa/134, Constitution House, New Delhi

56 Shri M. Shankaraiya, Member, Lok Sabha, Advocate, 111, Main Road, Vani Vilas Mohalla, Mysore City 14-D Ferozeshah Road, New Delhi

57 Sardar Iqbal Singh Member, Lok Sabha, House No. 662, Ward No. 6 Abohar, Punjab/85, C South Avenue, New Delhi

58 Shri P. R. Patel, Member, Lok Sabha, Pilaji Ganj, Mehsana, Bombay State

59 Shri Matadin Khaithan, 9, Ramkumar Rakhit Lane, Calcutta-7

60 Shri A. R. Foster, C/o M/s Imperial Chemical Industries (India) Private Ltd., P.O. Box No. 107, New Delhi

61 Dr. B. N. Uppal, Agricultural Commissioner, with the Govt. of India, New Delhi

62 Shri Laxmi Sahai, Animal Husbandry Commissioner with the Govt. of India, New Delhi

63 Dr. B. S. Kadam, Agricultural Extension Commissioner with the Govt. of India, New Delhi

64 Dr. M. B. Ghatge, Agricultural Marketing Adviser to the Government of India, New Delhi

65 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi

66 Dr. N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar

67 The Director, Indian Institute of Science, Bangalore

68 Shri K. L. M. Ghose, Director, Central Rice Research Institute, Cuttack

APPENDIX IV—*contd.*

69 Dr. Pushkar Nath, Director, Central Potato Research Institute, Simla

70 Shri P. N. Datta, I.F.S., President, Forest Research Institute and College P.O. New Forest, Dehra Dun

71 Dr. M. D. Patel, Director, Institute of Agriculture, Anand

72 Dr. K. K. Iya, Director, National Dairy Research Institute, Karnal

73 Shri Thakur Das Bhargava, Member, Lok Sabha, Anand Bhavan, Hissar or 31, Canning Lane, New Delhi

74 Shri T. S. Krishnamurti, Secretary, Central Board of Forestry, Deptt. of Agriculture, Government of India, New Delhi

75 Dr. M. S. Thacker, Director General, Council of Scientific & Industrial Research, New Delhi

76 Shrimati Lilavati Munshi, Member, Rajya Sabha, Bharatiya Vidya Bhavan, Chowpatty Road Bombay/Curzon Road, New Delhi

77 Shri G. C. Takle, I.F.S., Inspector General of Forests, Deptt. of Agriculture, Govt. of India, New Delhi

78 Dr. G. G. Pandit, Director, Indian Council of Medical Research, New Delhi

79 Dr. A. C. Joshi, Vice-Chancellor, Punjab University, Chandigarh

80 Shri K. P. Bhatnagar, Vice-Chancellor, Agra University, Agra

81 Dr. V. S. Krishna, Vice-Chancellor, Andhra University, Waltair

82 Dr. P. K. Parja, Vice-Chancellor, Utkal University, Cuttack

83 Shri H. Fergusen, Director, Scientific Department, Indian Tea Association, P.O. Chinnamara, Assam

84 Shri K. T. Uthappa, Bison Field Estate, Sidapur Post, S. Coorg

85 Shri T. Jacob, Kaithayil House, Mangam, Kottayyam, Kerala State

86 Dr. B. L. Sethi, Secretary, Indian Central Cotton Committee, 14, Nicol Road, Ballard Estate, Bombay-1

87 Shri N. B. Maity, Member Lok Sabha, Representative of Indian Central Jute Committee, 149—A, North Avenue New Delhi

88 Shri B. L. Singh, C/o M/s Bhagirath Ram & Sons, 14, Bentick Street, Calcutta

89 Shri C. Bali Reddy, Member, Lok Sabha, Secretary, Andhra Provincial Kisan Sammelan, Cumbum, Distt. Kurnool

90 Shri P. Balarama Kurup, Technochemical Industries, P.O. Box No. 74, Kozhikode, Malabar Distt. Kerala

91 Shri Mohanlal Ambala Parkh, C/o Messrs. Mohanlal Hargovindas, 51, Dadyseth Agiary Lane, Bombay 2

92 Shri G. U. Urao, 54, Kondappa Chetty Street, G. T., Madras-1

93 Shri C. T. Ittiachan, Kaotanad Estate, South Malabar, Kerala State

94 Shri Madanmohan R. Ruai, C/o M/s. Ramnarain Sons Private Ltd., State Bank Building, Annexe, Bank Street, Fort, Bombay 1

APPENDIX IV—*concld.*

95 The Director of Remounts, Veterinary & Farms, Quarter Master General's Branch, Army Head Quarters, New Delhi

96 Shri T. G. Walton, Vice-President, Indian Central Jute Committee C/o Thomas Duff & Co. (India) Ltd., Clive Road, Calcutta

97 Sardar Lal Singh, Village & P.O. Nandpur, District Ludhiana, or 7 Kotah House, New Delhi

98 Shri K. P. Madhavan Nair, Member, Rajya Sabha, Vice-President Indian Central Coconut Committee, Ernakulam Mills Buildings Ernakulam, or 26, Queen Victorial Road, New Delhi

99 Shri Ratilal M. Gandhi, Ratilal & Co., Currimjee Building, 111, Mahatma Gandhi Road, Fort, Bombay, 1

100 Shri U. Subaraya Mallia, Vice-President, Indian Central Arecanut Committee, C/o M/s Subaraya Mallia & Co. Ltd., Exporters, Bunder, Mangalore

101 Dr. S. K. Sen, Economic & Statistical Adviser, Department of Agriculture, Government of India, New Delhi

102 Dr. N. K. Panikar, Fisheries Development Adviser to the Government of India, Ministry of Agriculture, New Delhi

103 Dr. V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi

104 Shri K. L. Ghei, Joint Secretary to the Govt. of India, Ministry of Finance (Food & Agri. Div.) & Financial Adviser, Indian Council of Agricultural Research, New Delhi

105 Shri O. P. R. Reddiar, Subha Sanmargha Nilayam, Vadalur, P.O. Vadalur, Via Cuddalore Junction, South Arcot District

106 Shri J. Raghotam Reddy, Malyal Village, Fateh Maidan, North Road, Hyderabad-Deccan

107 Shri Sri Kanth Kaul, C/o Parkash Seed Farm, Srinagar

108 Shri K. P. Amrithatha Iyer, Kottarathu, Madhom Moncompu, Kerala State

109 Shri Baburao Krishanji Patil, Landholder, P.O. Digras, District Yeotimal, Bombay

110 Sardar Satwant Singh, Nasirpur Farm, P.O. Bahadurgarh Fort, Patiala

111 Shri J. S. Patil, B.A.LL.B., Chalisgaon, District East Khandesh, Bombay State

112 Dr. L. S. Negi, Director of Agriculture, Himachal Pradesh, Simla

113 Shri G. C. Negi, Deputy Director of Animal Husbandry, Himachal Pradesh, Simla

114 Dr. M. Channa Reddy, M.L.A., Anand Niwas, Lalguda, Secunderabad, Andhra Pradesh

APPENDIX V

**List of Members of the Governing Body**

1 Shri A. P. Jain, Minister for Food & Agriculture, Government of India, New Delhi (President)

2 Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi

3 Shri M. V. Krishnappa, Deputy Minister for Agriculture, Government of India, New Delhi

4 Shri P. Thimma Reddy, Minister in charge of Agriculture, Animal Husbandry, Forest and Fisheries, Government of Andhra Pradesh Hyderabad-Deccan

5 Shri Moinul Haque Chaudhury, Minister in charge of Agriculture (including Food production) Veterinary, Animal Husbandry and Pisciculture, Government of Assam, Shillong

6 Shri Bir Chand Patel, Minister in charge of Agriculture, Veterinary and Cooperation, Government of Bihar, Patna

7 Shri Vasant Phulsing Naik, Minister for Agriculture, (including Veterinary and Animal Husbandry) and Aarey Milk Colony, Government of Bombay, Sachivalaya, Bombay

8 Shri C. Achutha Menon, Minister in charge of Finance and Agriculture (including Veterinary and Animal Husbandry), Government of Kerala, Trivandrum

9 Shri Takhat Mal Jain, Minister for Industries in charge of Agriculture, (including Veterinary and Animal Husbandry) Government of Madhya Pradesh, Bhopal

10 Shri M. Bhaktavatsalam, Home Minister in charge of Agriculture, and Animal Husbandry, Government of Madras, Fort St. George, Madras

11 Shri H.S. Rudrappa, Minister for Agriculture and Forest, Government of Mysore, Mysore Government Secretariat, Vidhan Soudha, Bangalore

12 Shri Radha Nath Rath, Minister in charge of Agriculture, (including Veterinary and Animal Husbandry) Government of Orissa, Cuttack

13 Shri Gurbanta Singh, Development Minister in charge of Agriculture Government of Punjab, Chandigarh

14 Shri Nathu Ram Mirdha, Minister in charge of Agriculture, Cooperation and Forests, Government of Rajasthan, Jaipur

15 Shri Hukam Singh Visen, Minister in charge of Agriculture, (including Veterinary and Animal Husbandry) Government of Uttar Pradesh, Lucknow

16 Dr. R. Ahmed, Minister in charge of Agriculture, Animal Husbandry and Forests, Government of West Bengal, Calcutta

17 Shri Abdul Gani Trali, Minister in charge of Agriculture, Government of Jammu and Kashmir, Srinagar/Jammu Tawi

18 Shri P. B. Thapar, I.C.S., Secretary to the Government of India, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

APPENDIX V—*contd.*

19 Shri A. D. Pandit, I.C.S., Chief Commissioner of Delhi, Delhi

20 Shri Bajrang Bahadur Singh, Lt. Governor of Himachal Pradesh, Simla

21 Shri P. C. Mathew, I.C.S., Chief Commissioner of Manipur, Imphal

22 Shri K. P. Bhargava, I.C.S., Chief Commissioner of Tripura, Agartala

23 Shri T. G. N. Ayyar, I.C.S., Chief Commissioner, Andaman and Nicobar Islands, Port Blair

24 Shri S. Moni, Administrator, Laccadive, Minicoy and Amindivi Island Kozhikode-4.

25 Shri K. Madhva Menon, Member, Rajya Sabha, Padmalayam Kozhikode, Malabar/71, North Avenue, New Delhi

26 Shri T. Sanganna, Member, Lok Sabha, Rayaguda, P.O. Rayaguda, District Koraput, Orissa/134, Constitution House, New Delhi

27 Shri M. Shankaraiya, Advocate, Member, Lok Sabha, 111 Main Road, Vani Vilas Mohalla, Mysore City/14-D, Ferozeshah Road, New Delhi

28 Dr. H. K. Nandi, Director of Agriculture, West Bengal, Calcutta

29 Shri K. L. Ghei, Joint Secretary, Ministry of Finance, (F. & A. Division), Government of India, and Financial Adviser, Indian Council of Agricultural Research, New Delhi

30 Shri Thakur Das Bhargava, Member, Lok Sabha, Anand Bhavan, Hissar/31 Canning Lane, New Delhi

31 Shri Baburao Krishanaji Patil, Landholder and President, Municipal Committee Digras, District Yeotmal, Bombay State

32 Sardar Satwant Singh, Landholder, Nasirpur Farm, Bahadurgarh Fort, Patiala

33 Dr. M. Channa Reddy, M.L.A., Anand Niwas, Lalguda, Secunderabad Hyderabad-Deccan, 17, Andhra Pradesh

APPENDIX VI

**List of Members of the Standing Finance Committee as on 7th March 1958**

1 Shri P. N. Thapar, I.C.S., Secretary to the Government of India, Ministry of Food and Agriculture, (Department of Agriculture), New Delhi

2 Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi

3 Shri K. L. Ghei, Financial Adviser, Indian Council of Agricultural Research, New Delhi

4 Shri Thakur Das Bhargava, Member, Lok Sabha, Anand Bhavan, Hissar

5 Shri Moinul Haque Chaudhury, Minister in charge of Agriculture, (including Food production) Veterinary, Animal Husbandry and Pisciculture, Government of Assam, Shillong

6 Shri Vasant Phulsing Naik, Minister for Agriculture, (including Veterinary and Animal Husbandry) and Aarey Milk Colony, Government of Bombay, Sachivalaya, Bombay

7 Shri M. Shankaraiya, Advocate, Member, Lok Sabha, 111 Main Road Vani Vilas Mohalla, Mysore City

8 Dr. E. S. Naryanan, Professor, Central College of Agriculture, P.O. Indian Agricultural Research Institute, New Delhi

9 Shri H. R. Kapur, Principal, Bihar Veterinary College, Patna

APPENDIX VII

**List of Members of the Advisory Board as corrected up to 31st March 1958**

1 Dr. M. S. Randhawa, I.C.S., Vice-President, Indian Council of Agricultural Research, New Delhi

2 Dr. B. N. Uppal, Agricultural Commissioner with the Government of India, New Delhi

3 Shri Laxmi Sahai, Animal Husbandry Commissioner with the Government of India, New Delhi

4 Dr. B. S. Kadam, Agricultural Extension Commissioner with the Government of India, New Delhi

5 Dr. M. B. Ghatge, Agricultural Marketing Adviser to the Government of India, New Delhi

6 Dr. S. R. Sen, Economics & Statistical Adviser to the Govenment of India, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

7 Dr. V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi

8 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi

9 Shri N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar

10 Director, Indian Institute of Science, Bangalore

11 Dr. K. K. Iya, Director, National Dairy Research Institute, Karnal

12 Shri K. L. M. Ghose, Director, Central Rice Research Institute, Cuttack

13 Dr. Pushkar Nath, Director, Central Potato Research Institute, Simla

14 Shri Rai Prithvi Raj, Director of Agriculture, Andhra Pradesh, Hyderabad-Deccan

15 Shri L. K. Hardique, Director of Agriculture, Assam, Shillong

16 Shri B. P. Akhaury, Director of Agriculture, Bihar, Patna

17 Shri S. P. Mohite, I.A.S., Director of Agriculture, Bombay State, Poona

18 Shri P. D. Nair, Director of Agriculture, Kerala State, Trivandrum

19 Shri A. Venkatesan, I.A.S., Director of Agriculture, Madras State, Madras

20 Shri S. S. Apte, Director of Agriculture, Madhya Pradesh, Rewa

21 Shri M. Mallaraj Urs, Director of Agriculture, Mysore State, Bangalore

22 Shri G. C. Dash, I.A.S. Director of Agriculture & Food Production, Orissa, Cuttack

23 Dr. Arjan Singh, Director of Agriculture, Punjab, Simla

24 Shri Samrath Raj, Director of Agriculture & Veterinary Services, Rajasthan, Jaipur

25 Shri Ram Surat Singh, Director of Agriculture, Uttar Pradesh, Lucknow

26 Dr. H. K. Nandi, Director of Agriculture, West Bengal, Calcutta

APPENDIX VII—*contd.*

27 Shri G. M. Butt, Director of Agriculture, Jammu & Kashmir, Srinagar/ Jammu Tawi

28 Shri N. Bhagwandas, I.A.S., Director of Animal Husbandry, Andhra Pradesh, Hyderabad-Deccan

29 Shri M. I. Malik, Director of Veterinary Services and Animal Husbandry, Assam, Gauhati

30 Shri S. K. Sen, Director of Animal Husbandry, Bihar, Patna

31 Shri S. R. Chadha, Director of Veterinary Services, Bombay State, Poona

32 Shri V. K. Madhva Menon, Director of Animal Husbandry, Kerala State, Trivandrum

33 Shri D. Pattabhiraman, Director of Animal Husbandry, Madras State, Madras

34 Shri G. C. Juneja, Director of Veterinary Services, Madhya Pradesh, Bhopal

35 Shri Gurbachan Singh, Director of Veterinary Services and Animal Husbandry, Orissa, Cuttack

36 Dr. K. S. Shetty, Director of Animal Husbandry, Mysore State, Bangalore

37 Shri Mohan Singh Malhi, Director of Veterinary Services and Warden of Fisheries, Punjab, Simla

38 Dr. P. G. Pande, Director of Animal Husbandry, Uttar Pradesh, Lucknow

39 Shri J. M. Lahiri, Director of Veterinary Services and Animal Husbandry, West Bengal, Calcutta

40 Director of Veterinary Services, Jammu & Kashmir, Srinagar/Jammu Tawi

41 Shri R.N. Datta, I.F.S., President, Forest Research Institute & College, P.O. New Forest, Dehra Dun.

42 Shri B. N. Handa, Director of Veterinary Services and Animal Husbandry, Rajasthan, Jaipur

43 Shri J. S. Patil, B.A.LL.B., Chalisgaon, District East Khandesh, Bombay State

44 Dr. C. G. Pandit, Director, Indian Council of Medical Research, New Delhi

45 Dr. P. K. Pariaj, Vice-Chancellor, Utkal University, Cuttack

46 Dr. V. S. Krishna, Vice-Chancellor, Andhra University, Waltair

47 Shri K. P. Bhatnagar, Vice-Chancellor, Agra University, Agra

48 Dr. A. C. Joshi, Vice-Chancellor, Punjab University, Chandigarh

49 Shri H. Ferguson, Director, Indian Tea Association, Tea Department, P.O. Chinnamara, Assam

50 Shri B. L. Sethi, Secretary, Indian Central Cotton Committee, 14, Nico Road, Ballard Estate, Bombay-1

51 Shri N. B. Maity, Member, Lok Sabha, 149-A, North Avenue, New Delhi

APPENDIX VII—*contd.*

52 Shri B. L. Singh, C/o M/s Bhagirath Ram & Sons, 14, Bentick Street, Calcutta

53 Shri C. Bali Reddy, M.P., Secretary, Andhra Provincial Kisan Sammelan, Cumbum, District, Kurnool

54 Shri P. Balarama Kurup, Techno-Chemical Industries, P. O. Box No. 74-Kozhikode, Malabar District

55 Shri Mohanlal Ambalal Parikh, C/o M/s Mohanlal Hargovinddas, 51-Dadyseth, Agiary Lane, Bombay-2

56 Shri G. U. Rao, 54, Kondappa Chetty Street, G. T. Madras-1

57 Shri C. T. Ittiachin, B.Sc. Ag., Kootanad Estate, Kootanad, South Malabar, Kerala State

58 Shri K. T. Uthappa, Bison Field Estate, Sidapur Post, South Coorg

59 Shri T. A. Jacob, Kaithayil House, Mangam, Kottayyam, Kerala State

60 Dr. N. K. Panikar, Fisheries Development Adviser to the Government of India, Ministry of Food & Agriculture, (Department of Agriculture) New Delhi

61 Dr. B. K. Mukherjee, Director, Indian Institute of Sugarcane Research, Lucknow

62 Dr. N. L. Dutt, Director, Sugarcane Breeding Institute, Coimbatore

63 Dr. T. J. Mirchandani, Director, Agronomic Survey Experiments, Indian Council of Agricultural Research, New Delhi

64 Dr. E. S. Narayanan, Head of the Division of Entomology, Indian Agricultural Research Institute, New Delhi

65 Dr. R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, New Delhi

66 Dr. K. C. Naik, Principal, Agricultural College and Research Institute, and Joint Director of Agriculture Research, Coimbatore

67 Col. R. N. Chopra, Honorary Scientific Adviser, Regional Research Laboratory, Jammu Tawi

68 Dr. V. Subrahamanyan, Director, Central Food Technological Research Institute, Mysore

69 Shri D. A. Gadkari, Officer on Special Duty Political Services Department (Planning and Development) Government of Bombay, Bombay

70 Dr. S. S. Purewal, Vegetable Botanist to the Government of Punjab, Agricultural College, Ludhiana

71 Dr. L. C. Sikka, Dairy Development Adviser to the Governmen of India, Ministry of Food & Agriculture, (Department of Agriculture), New Delhi

72 Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, 48/48, Chanakyapuri, New Delhi

73 Shri S. S. Khot, Sheep & Wool Liaison Officer, Indian Council of Agricultural Research, New Delhi

74 Shri S. G. Iyer, Head of the Division of Poultry, Indian Veterinary Research Institute, Izatnagar

APPENDIX VII—*concld.*

75 Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, Barrackpore, Calcutta

76 Dr. S. Krishnaswamy, Entomologist, Indian Lac Research Institute, Namkum (Ranchi)

77 Sardar Lal Singh, Vice-President, Indian Central Sugarcane Committee, 7, Kotah House, New Delhi

78 Dr. P. J. Gregory, Secretary, Indian Central Coconut Committee, Ernakulam

79 Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee, 38, Mount Road, Madras 6

80 Dr. R. Sankaran, Secretary, Indian Central Oilseeds Committee, Gandhi Bhavan, Hyderabad-Deccan

81 Shri B. S. Varadarajan, Secretary, Indian Central Arecanut Committee, P.B. No. 14 Kozhikode 1 (Calicut), South India

82 Dr. J. S. Patel, Adviser (Agriculture), Ministry of Community Development, New Delhi

83 Dr. P. M. N. Naidu, Adviser (Animal Husbandry), Ministry of Community Development, New Delhi

84 The Director of Remounts, Veterinary and Farms, Quarter Master General's Branch, Army Headquarters, New Delhi

85 Dr. R. L. Kaura, Livestock Development Adviser to the Government of India, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

86 Shri Bishan Mansingh, Chairman U.P., Board of Agriculture, Fatehpur Uttar Pradesh

87 Shri K. D. Sharma, Secretary, Farmers Forum, India, Jawaharmal Mansion, 3/15-A, Ajmeri Gate Extension, New Delhi

88 Dr. Z. R. Kotha Valla, 8, Ali Aksar Road, Bangalore

89 Dr. P. S. Khankhoje, C/o Shri R. K. Patel, Civil Lines, Nagpur

90 Dr. M. D. Patel, Director, Institute of Agriculture, Anand

91 Dr. L. S. Negi, Director of Agriculture, Himachal Pradesh, Simla

92 Shri G. C. Negi, Deputy Director of Animal Husbandry, Himachal Pradesh, Simla-4

93 Dr. V. R. Khonalkar, Director, Indian Cancer Research Centre, Parel, Bombay

APPENDIX VIII

**List of Members of the Board of Research as on the 31st March 1958**

1 Dr. M. S. Randhawa, I.C.S. Vice-President, Indian Council of Agricultural Research, New Delhi

2 Dr. B. N. Uppal, Agricultural Commissioner with the Government of India, New Delhi

3 Shri L. Sahai, Animal Husbandry Commissioner with the Government of India, New Delhi

4 Dr. B. S. Kadam, Agricultural Extension Commissioner with the Government of India, New Delhi

5 Dr. V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi

6 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi

7 Dr. N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar

8 Dr. K. K. Iya, Director, National Dairy Research Institute, Karnal

9 Shri K. L. M. Ghose, Director, Central Rice Research Institute, Cuttack

10 Dr. Pushkar Nath, Director, Central Potato Research Institute, Simla

11 Dr. B. K. Mukherjee, Director, Indian Institute of Sugarcane Research, Lucknow

12 Shri B. N. L. Dutt, Director, Sugarcane Breeding Institute, Coimbatore

13 Shri R. N. Datta, I.F.S., President, Forest Research Institute & Colleges, P.O. New Forest, Dehra Dun

14 Dr. V.N. Khanolkar, Director, Indian Cancer Research Centre, Parel, Bombay

15 Dr. T.J. Mirchandani, Director, Agronomic Survey Experimentation, Indian Council of Agricultural Research, New Delhi

16 Dr. V. Subramanyan, Director, Central Food Technological Research Institute, Mysore

17 Dr. R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, New Delhi

18 Dr. E. S. Narayanan, Head of the Division of Entomology, Indian Agricultural Research Institute, New Delhi

19 Dr. K. C. Naik, Principal, Agricultural College & Research Institute & Joint Director of Agriculture (Research), Coimbatore

20 Shri D. A. Gadkari, Officer on Special Duty, Political & Services Department (Planning & Development), Government of Bombay, Bombay.

21 Col. R. N. Chopra, Honorary Scientific Adviser, Regional Research Laboratory, Jammu Tawi

22 Dr. L. C. Sikka, Dairy Development Adviser to the Government of India, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

APPENDIX VIII—*contd.*

23 Shri S. G. Iyer, Head of the Division of Poultry, Indian Veterinary Research Institute, Izatnagar

24 Shri S. S. Khot, Liaison Officer (Sheep & Wool), Indian Council of Agricultural Research, New Delhi

25 Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, 48/48, Chanakya Puri, New Delhi.

26 Dr. S.S. Purewal, Vegetable Botanist to the Government of Punjab, Agricultural College, Ludhiana.

27 Dr. B. L. Sethi, Secretary, Indian Central Cotton Committee, 14-Nicol Road, Ballard Estate, Bombay

28 Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, Barrackpore, Calcutta

29 Dr. S. Krishnaswamy, Entomologist, Indian Lac Research Institute, Nankum, Ranchi

30 S. Lal. Singh, Vice-President, Indian Central Sugarcane Committee, 7, Kotah House, New Delhi

31 Dr. P. J. Gregory, Secretary, Indian Central Coconut Committee, Ernakulam

32 Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee, 38, Mount Road, Madras

33 Dr. R. Sankaran, Secretary, Indian Central Oilseeds Committee, Gandhi Bhawan, Hyderabad-1

34 Shri B. S. Varadarajan, Secretary, Indian Central Arecanut Committee, P.B. No. 14, Kozhikode-1 (Calicut)

35 Dr. J. S. Patel, Adviser (Agriculture), Ministry of Community Development, Government of India, New Delhi

36 Dr. P. M. Narayanaswamy Naidu, Adviser (Animal Husbandry) Ministry of Community Development, Government, of India, New Delhi

## APPENDIX IX

### List of Members of the Executive Committee

1 Vice President, I.C.A.R. (Chairman)
2 Agricultural Commissioner, I.C.A.R.
3 Animal Husbandry Commissioner, I.C.A.R.
4 Extension Commissioner, Ministry of Food & Agriculture
5 Director, Indian Agricultural Research Institute, New Delhi
6 Director, Indian Vety. Research Institute, Izatnagar
7 Chief of Agriculture Education, I.C.A.R.
8 Director, Forest Research Institute, Dehra Dun
9 Principal, Agri. College, Gwalior
10 Principal, Agri. College, Ludhiana
11 Principal, Agri. College, Sabour
12 Principal, College of Agriculture, Poona
13 Principal, Agricultural College, Coimbatore
14 Principal, Vety. College, Mathura
15 Principal, Vety. College, Bikaner
16 Principal, Vety. College, Calcutta
17 Principal, Vety. College, Hyderabad
18 Principal, Vety. College, Trichur
19 Principal, Agri. College, Banaras
20 Principal, Institute of Agriculture, Anand
21 Directress, Lady Irwin College, New Delhi
22 Director, Rural Institute, Amravati
23 Dr. E. Hixson, Agr. Education Adviser, TCM.

APPENDIX X

**List of Members on Working Party on Agriculture**

1 Dr. B. N. Uppal, Agricultural Commissioner with the Government of India, New Delhi

2 Dr. B. S. Kadam, Agricultural Extension Commissioner with the Government of India, New Delhi

3 Dr. V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi

4 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi

5 Shri K. L. M. Ghose, Director, Central Rice Research Institute, Cuttack

6 Dr. Pushkar Nath, Director, Central Potato Research Institute, Simla

7 Dr. B. K. Mukherjee, Director, Indian Institute of Sugarcane Research, Lucknow

8 Shri N. L. Dutt, Director, Sugarcane Breeding Institute, Coimbatore

9 Shri R.N. Dutt, I.F.S., President, Forest Research Institute & Colleges, P.O. New Forest, Dehra Dun

10 Dr. T. J. Mirchandani, Director, Agronomic Survey & Experimentation, Indian Council of Agricultural Research, New Delhi

11 Dr. V. Subrahmanyan, Director, Central Food Technological Research Institute, Mysore

12 Dr. R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, New Delhi

13 Dr. E. S. Narayanan, Head of the Division of Entomology, Indian Agricultural Research Institute, New Delhi.

14 Dr. K. C. Naik, Principal, Agricultural College & Research Institute & Joint Director of Agriculture (Research), Coimbatore

15 Col. R. N. Chopra, Honorary Scientific Adviser, Regional Research Laboratory, Jammu Tawi

16 Shri D. A. Gadkari, Officer on Special Duty, Political & Services Department (Planning & Development), Govt. of Bombay, Bombay

17 Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, Parliament Street, New Delhi

18 Dr. B. L. Sethi, Secretary, Indian Central Cotton Committee, 14, Nicol Road, Ballard Estate, Bombay

19 Dr. B. C. Kundu, Director, Jute Agricultural Research Institute, Barrackpore, Calcutta

20 Dr. S. Krishnaswamy, Entomologist, Indian Lac Research Institute, Namkum Ranchi

21 S. Lal Singh, Vice-President, Indian Central Sugarcane Committee, 7, Kotah House, New Delhi

22 Dr. P. J. Gregory, Secretary, Indian Central Coconut Committee, Ernakulam

23 Dr. M. S. Patel, Secretary, Indian Central Tobacco Committee, 38, Mount Road, Madras

APPENDIX X—*contd.*

24 Dr. R. Sankaran, Secretary, Indian Central Oilseeds Committee, Gandhi Bhavan, Hyderabad-1

25 Shri B. S. Varadarajan, Secretary, Indian Central Arecanut Committee, P.B. No. 14, Kozhikode-1 (Calicut)

26 Dr. J. S. Patel, Adviser (Agriculture), Ministry of Community Development, Government of India, New Delhi

27 Dr. V. N. Khanolkar, Director, Indian Cancer Research Centre, Parel, Bombay 12

28 Dr. S. S. Purewal, Vegetable Botanist to the Government of Punjab, Agricultural College, Ludhiana.

APPENDIX XI

**List of Members of the Working Party on Animal Husbandry**

1 Shri L. Sahai, Animal Husbandry Commissioner with the Government of India, New Delhi

2 Dr. B. S. Kadam, Agricultural Extension Commissioner, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

3 Dr. V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi

4 Dr. N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar

5 Dr. K. K. Iya, Director, National Dairy Research Institute, Karnal

6 Dr. L. C. Sikka, Dairy Development Adviser to the Government of India, Ministry of Food & Agriculture (Department of Agriculture), New Delhi

7 Shri S.S. Khot, Liaison Officer (Sheep & Wool), Indian Council of Agricultural Research, New Delhi

8 Shri S. G. Iyer, Head of the Division of Poultry, Indian Veterinary Research Institute, Izatnagar

9 Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, Parliament Street, New Delhi

10 Dr. P. M. Narayanaswamy Naidu, Adviser (Animal Husbandry), Ministry of Community Development, Government of India, New Delhi

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APPENDIX XII

**Scientific Committees**

**BOTANY COMMITTEE**

1 Shri Boshi Sen, Director, Vivekananda Laboratory, Almora
2 Dr. T. R. Mehta, Principal, Agricultural College and Joint Director of Agriculture, Madhya Pradesh, Gwalior
3 Shri Laxmi Singh Negi, Director of Agriculture, Himachal Pradesh, Simla
4 Shri V. M. Chavan, 898, Radha Niwas, Poona
5 Shri R. B. Ekbote, Wheat Specialist to Government of Madhya Pradesh, Hoshangabad.
6 Shri P. D. Gadkari, Head of Regional Research Station, Amravati, Bombay State
7 Dr. A. C. Joshi, Vice-Chancellor, Punjab University, Chandigarh
8 Dr. R. H. Richaria, Principal, Agricultural College, Sabour, Bihar
9 Shri M. B. V. Narasingarao, Dabagardens, Waltair, Rly. Station, Andhra Pradesh
10 Dr. A. K. Paul, Economic Botanist to Government, West Bengal, 1, Rani Kutir Tollygunge, Calcutta-33
11 Dr. A Abraham, Prof. of Botany, University of Travancore, Trivandrum
12 Prof. R. H. Dastur, 52, The Mall, Mhow, Madhya Pradesh
13 Shri B. N. Duare, Economic Botanist to Government of Assam, Shillong
14 Dr. R. K. Mitra, Economic Botanist to Government of Uttar Pradesh, Lucknow
15 Dr. P. C. Maheshwari, Dean of the Faculty of Science and Head of the Department of Botany, University of Delhi, Delhi
16 Dr. S. Solomon, Superintending Agricultural Officer, Bombay Division, Nasik
17 Shri P. W. X. Ponniah, Millet Specialist to Government of Madras, Coimbatore
18 Dr. P. S. Khankhoje, C/o Shri R. K. Patil, Civil Line, Nagpur
19 Dr. K. Ramiah, 'Swathi' 552, XIX Cross Road, Bangalore 3
20 Shri H. B. Shahi, Animal Husbandry Commissioner and Addl. Secretary to the Government of Uttar Pradesh (A.H. Deptt.), Lucknow
21 Dr. P. Bhattacharya, Head of the Division of Animal Genetics, I.V.R.I., Izatnagar
22 Dr. K. C. Bora, Atomic Energy Department (Biology Division), Trombay, Bombay

*Ex-officio Members*

1. Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi
2 Head of the Division of Botany, I.A.R.I., New Delhi
3 Director, Central Rice Research Institute, Cuttack

APPENDIX XII—*contd.*

*Committee to promote and coordinate work on the application of radio-active isotopes in Agriculture I.C.A.R.*

1 Dr. B. N. Uppal, Agricultural Commissioner, I.C.A.R., New Delhi—Chairman

2 Dr. B. P. Pal, Director, Indian Agricultural Research Instiurte, New Delhi—Member

3 Dr. N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh—Member

4 Dr. V. R. Khanolkar, Director, Indian Cancer Research Institute, Parel, Bombay—Member

5 Dr. R. S. Vasudeva, Head of the Division of Mycology, I.A.R.I., New Delhi—Member

6 Dr. K. T. Jacob, Head of the Department of Botany, Bose Research Institute, Calcutta—Member

7 Shri Boshi Sen, Director, Vivekananda Laboratory, Almora, Uttar Pradesh—Member

8 Dr. N. P. Datta, Agronomist, I.A.R.I., New Delhi—Member

9 Dr. M. S. Swaminathan, Cytogeneticist, I.A.R.I., New Delhi—Member

10 One representative of the Department of Atomic Energy, Government of India, Bombay—Member

**VEGETABLE COMMITTEE**

*Subject*—Vegetables and Tuber Crops

*Members by Name*

1 Dr. S. S. Purewal, Vegetable Botanist, Government of Punjab, Agriculture College, Ludhiana

2 Dr. Pushkar Nath, Director, C.P.R.I., Simla

3 Dr. Y. R. Mehta, Horticulturist, Horticultural College, Kanpur

4 Shri U. S. Kang, Vegetable Specialist, Jammu & Kashmir State, Srinagar

5 Dr. P. S. Parsai, 2nd Horticulturist, Madhya Pradesh, Pachmari

6 Shri Bhujanga Rao, Fruit Specialist, Andhra Pradesh, Government Fruit Research Station, Anantharajupeth, P.O. Cuddapah District

7 Shri T. Gopalan Nayar, Plantations Officer, Kerala State

8 Shri U. Narsingha Rao, Horticulturist & Prof. of Horticulture, Agriculture College, Coimbatore

9 Dr. P. Abraham, Professor of Botany, Travancore University, Trivandrum

10 Shri H. B. Singh, Botany Division, I.A.R.I., New Delhi

11 Dr. R. S. Chaudhry, Reader in Agricultural Botany, Banaras Hindu University, Banaras

12 Dr. B. A. Chaugule, Professor of Agronomy, College of Agriculture, Poona

13 Dr. B. Chaudhri, Vegetable Breeder, Horticultural Division, I.A.R.I., New Delhi

14 Dr. J. N. Sharma, Agronomy Division, I.A.R.I., New Delhi

APPENDIX XII—*contd.*

*Ex-officio Members*

1 Dr. P. K. Kymal, Technical Adviser, Ministry of Food & Agriculture (Food Department)
2 Agricultural Marketing Adviser to the Government of India, New Secretariat Building, Nagpur
3 Dr. B. P. Pal, Director, I.A.R.I., New Delhi
4 Dr. R. S. Vasudeva, Head of the Division of Plant Pathology, I.A.R.I., New Delhi
5 Dr. E. S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi
6 Head of the Division of Agronomy, I.A.R.I., New Delhi
7 Dr. S. Krishnamurthi, Head of the Department of Horticulture, I.A.R.I., New Delhi
8 Shri Ibne Ali, Assistant Agricultural Adviser, Ministry of Community Development, New Delhi

**MEDICAL PLANTS COMMITTEE**

*Members by Name*

1 Col. R. N. Chopra, Hony. Scientific Adviser, Regional Research Laboratory, Bandivery Road, Srinagar
2 Dr. G. K. Karandikar, Professor of Pharmacology, Medical College, Baroda
3 Dr. K. P. Biswas, Director-in-charge Medicinal Plants Scheme, Government of West Bengal, Old Hindustan Building, Calcutta
4 Shri K. N. Kaul, Director, National Botanical Garden, Lucknow
5 Shri S. P. Sen, Bengal Chemical and Pharmaceutical Works Ltd., 164, Maniktala Main Road, Calcutta-11
6 Dr. B. Mukerjee, Director, Drug Research Institute, Lucknow
7 Dr. N. K. Dutta, Assistant Director Incharge, Deptt. of Pharmacology, Haffkine Institute, Parel, Bombay-12
8 Dr. M. S. Varma, Principal, Ayurvedic College, Banaras Hindu University, Banaras
9 Dr. S. Datta, 12/2 Old Ballygunge, Second Lane, Calcutta-19
10 Shri P.B. Karup, Managing Director, Techno Chemical Industries Ltd., Kozhikode, P. O. Box No. 74, Calicut
11 Dr. S. Krishnamurthi, Head of the Division of Horticulture, I.A.R.I., New Delhi

*Ex-officio Members*

1 Dr. B. P. Pal, Director, I.A.R.I., New Delhi
2 Shri S. K. Borkar, Drugs Controller, Director General of Health Services, Government of India, New Delhi
3 Dr. R. L. Badhwar, Incharge Chief Minor Forest Products Section, Forest Research Institute, P.O. New Forest, Dehra Dun
4 Dr. N. D. Kehar, Director, Indian Veterinary Research Institute, Izatnagar
5 Dr. R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, New Delhi

APPENDIX XII—*contd.*

**HORTICULTURE DEVELOPMENT BOARD**

1 Dr. M. S. Randhawa, I.C.S., Vice-President, I.C.A.R. (Chairman)

2 Dr. B. N. Uppal, Agricultural Commissioner, I.C.A.R.

3 Shri S. K. Mirchandani, Secretary, I.C.A.R.

4 Shri K. L. Ghei, Financial Adviser, Ministry of Food and Agriculture, New Delhi

5 Shri R. T. Mirchandani, Agricultural Marketing Adviser, Government of India, Dte. of Marketing and Inspection, New Secretariat Buildings, Nagpur

6 Dr. V. Subrahmanyan, Director, Central Food Technological Research Institute, Chaluvemba Mansion, Mysore

7 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi

8 Shri M.P. Bhargava, Cooperation Adviser, Deptt. of Agriculture, Ministry of Food and Agriculture, New Delhi

9 Dr. M.A. Rau, Regional Botanist, Northern Circle, Botanical Survey of India, 63, Rajpur Road, Dehra Dun

10 Shri N. V. Ganpule, Deputy Director, Small Industries Service Institute, 56 Sunder Nagar, New Delhi

11 Shri B. C. Desikachari, Chief Director of Movement, Ministry of Food, New Delhi

12 Dr. T.S. Gill, Assistant Chief Agriculture Planning Commission, New Delhi

13 Shri Ibne Ali, Assistant Agricultural Adviser, Ministry of Community Development, New Delhi

14 Shri Syed Hassan, Advocate and President, Bihar Horticultural Society, Kadamkunan, Patna-3

15 Shri Raje J. R. Deshmukh, Raver, East Khandesh, Bombay, Bombay State

16 Shri D. Raghav Reddy, Penagaluru, Cuddapah District (South India)

17 Shri M. L. Garg, C/o M/s L. R. Brothers, Seedmen and Nurserymen, Saharanpur (U.P.)

18 Shri K. U. Patel, C/o M/s Tims Products Ltd., Indian Exchange Building, Calcutta-1

19 Shri Jagdish Chatterji, 4, Ballardas Street, Calcutta-7

20 Shri R. V. Kalikar, President, Vidarbha Cooperative Bank and President, Orange Growers Association, Nagpur, Bombay State

21 Dr. P. S. Khankoje, C/o Shri R. K. Patel, Civil Lines, Nagpur

22 Shri Satwant Singh, Nasirabad Farm, Bahadurgarh Fort, Patiala

23 The Joint Director, Traffic (General) Railway Board, New Delhi

*24 S. Ujjal Singh, M.L.A., 12, Curzon Road, New Delhi

*Visitor only.

APPENDIX XII—*contd.*

**FLORICULTURE COMMITTEE**

*Ex-officio Members*

1 Dr. S. Krishnamurthy, Head of the Division of Horticulture, I.A.R.I. (Chairman)
2 Dr. B. N. Uppal, A.C., I.C.A.R.
3 Dr. S. M. Sikka, Addl. A.C., I.C.A.R.
4 Shri S. K. Mirchandani, Secretary, I.C.A.R.
5 Dr. Sham Singh, Dy. A.C. (F.D.) I.C.A.R.
6 Dy. Financial Adviser, I.C.A.R.

*Members by Name*

1 Raja Bajrang Bahadur Singh, Lt. Governor, Himachal Pradesh
2 Shri C. D. Deshmukh, Chairman, University Grants Commission, Old Mill Road, New Delhi
3 Dr. B. P. Pal, Director, I.A.R.I., New Delhi
4 The Superintendent, Government Gardens, Ootacamund
5 Shri M. B. Raizada, Forest Botanist, F.R.I., Dehradun
6 Shri M. L. Garg, Proprietor M/s L. R. Brothers, Saharanpur
7 Shri Bhanu L. Desai, Consultant Landscape Architect and Horticulturist, Dilkush, 3-Cross Road, Poona-1
8 Shri D. S. Pradhan, Proprietor, Chand Nursery, Rhonock, Sikkim State (West Bengal), India
9 Shri B. V. Bhagwat, Superintendent, Empress Garden, Poona
10 Shri P. N. Kohli, near Exhibition Ground, Srinagar, Kashmir
11 Shri S. Madhava Roa, M.Sc., 35, Pandara Road Flats, New Delhi
12 Dr J. S. Patel, Adviser, Agriculture and Cooperation, Community Project Administration, 9-Jorbagh, New Delhi
13 Dr. M. H. Marigowda, Superintendent, Government Botanic Gardens, Lal Bagh, Bangalore
14 Dr. D. N. Srivastava, Director, Fruits Utilization, Ranikhet, Uttar Pradesh.
15 Shri L. K. Hardique, Director of Agriculture, Assam, Shillong
16 Shri L. Venkataratnam, Horticulturist, Andhra Pradesh, Hyderabad
17 Shri V. K. Subramanyan, Quarantine Entomologist, Directorate of Plant Protection, Quarantine and Storage, 4/19, Ajmeri Gate Extension, New Delhi
18 Dr. L. B. Singh, Director, Government Horticulture Research Institute, Saharanpur, U. P.
19 A representative of Sikkim Darbar (Dewan of Sikkim, Gangtok)

**FRUIT COMMITTEE**

*Subject*— Fruits, Spices & Plantation Crops

*Members by Name*

1 Shri Bal Singh Bajwa, Late Fruit Specialist to the Government of Punjab, Jullundur City

APPENDIX XII—*contd.*

2 Shri Pradymna Singh, Horticulturist to Government of Madhya Pradesh, V.T.I. Building, Maharaj Bagh, Nagpur
3 Dr. K. C. Naik, Principal, Agricultural College and Research Institute, Lawley Road, P.O., Coimbatore (Chairman)
4 Shri N. Gopala Krishna, Horticulturist to Government of Bombay, Agricultural College, Poona-5
5 Shri K. Kripal Singh, Fruit Specialist to Government of Punjab, Patiala
6 Shri P. C. Mallick, Horticulturist to the Government of Bihar, Agriculture College, P.O. Sabour, Distt. Bhagalpur (Bihar)
7 Shri S. C. Bhattacharya, Officer on Special Duty (Agricultural Marketing), Office of the Director of Agriculture, Assam, Shillong
8 Shri A. R. Thapar, Horticultural Officer, Himachal Pradesh, Simla
9 Dr. S. K. Mukerji, Jt. Director, West Bengal, Writers' Buildings, Calcutta
10 Dr. Girdhari Lal, Assistant Director (Fruit Technology), Central Food Technological Research Institute, Cheluvamla Mansion, V. V. Mohalla, P. O. Mysore
11 Dr. L.B. Singh, Director, Horticultural Research Institute, Saharanpur, Uttar Pradesh
12 Shri C. Bhujanga Rao, Fruit Specialist, Andhra Pradesh
13 Shri L. Venkatratnam, Horticulturist, Andhra Pradesh, Hyderabad
14 Shri R. S. Roy, Principal, Agriculture College, Ranchi (Bihar)
15 Shri U. Narasingha Rao, Horticulturist to Government of Madras, Agricultural College, Coimbatore
16 Shri P. G. Kurup, Pepper Development Officer, Kerala State

*Ex-officio Members*

1 Dr. S.M. Sikka, Addl. Agricultural Commissioner to the Government of India
2 Dr. P. K. Kymal, Technical Adviser, Ministry of Food and Agriculture, (Food Division)
3 Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi
4 The Agricultural Marketing Adviser, Government of India
5 Dr. Sham Singh, Deputy Agricultural Commissioner (F. D.) to the Government of India
6 Dr. R. S. Vasudeva, Head of the Division of Plant Pathology, I.A.R.I., New Delhi
7 Dr. E. S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi
8 A representative of the Ministry of Community Development
9 The Officer on Special Duty (Spices), I.C.A.R.
10 Dr. R. L. Nagpal, Horticulturist, Citrus-Die-back Scheme, Bombay State
11 Dr. K. M. Aiyappa, Horticulturist, Citrus-Die-Back Scheme, Gonnicopal (Coorg)
12 Dr. S. Krishnamurthi, Head of the Division of Horticulture, I.A.R.I., New Delhi

APPENDIX XII—*contd.*

**PLANT DISEASES COMMITTEE**

*Members by Name*

1 Dr. S. Chattopadhya, Plant Pathologist, to the Government of West Bengal, 230, Netaji Subhas Road, Calcutta-40

2 Dr. R. S. Mathur, Plant Pathologist to the Government of Uttar Pradesh, Agricultural College, Kanpur

3 Dr. J. N. Mishra, Plant Pathologist to the Government of Bihar, P.O. Sabour, District Bhagalpur

4 Dr. Kishen Singh Bedi, Plant Pathologist to Government of Punjab, Agricultural College, Ludhiana

5 Dr. M. K. Patel, 12, Poona-Bombay Road, Poona-3

6 Dr. T. S. Ramakrishna, Rubber Pathologist, Indian Rubber Board, Kottayam, Travancore-Cochin

7 Dr. N. Prasad, Plant Pathologist to the Government of Rajasthan, Udaipur

8 Dr. Raghunath Prasad Asthana, Principal, Agricultural College, Nagpur

9 Syed Vaheeduddeen, Plant Pathologist to Government of Andhra Pradesh, Himayatsagar, Hyderabad-Deccan

10 Dr. T. S. Sadasivan, Director, Botany Laboratory, University of Madras, Madras

11 Shri S. Chowdhury, Mycologist to Government of Assam, Jorhat

12 Shri M. K. Desai, Plant Pathologist to Government of Bombay State, Poona-5

13 Shri M. Govinda Rao, Mycologist to Government, Andhra, Agricultural College, Bapatla (Andhra Pradesh)

*Ex-officio Members*

1 Dr. B. P. Pal, Director, I.A.R.I., New Delhi

2 Dr. R. S. Vasudeva, Head of the Division of Mycology, I.A.R.I., New Delhi

3 Dr. T. R. Mehta, Dy. Director (Plant Disease), Directorate of Plant Protection, Quarantine and Storage, Ministry of Food and Agriculture, Government of India, New Delhi

*Visitors*

1 Shri M. Abdus Salam, Reader, Department of Botany, Osmania University, Hyderabad

2 Dr. C. V. Subramanian, Prof. of Botany, University Botany Laby., Madras

APPENDIX XII—*contd.*

**CENTRAL SPICES & CASHEWNUT COMMITTEE**

1 Dr. B. N. Uppal, Agricultural Commissioner with the Govt. of India, I.C.A.R., New Delhi
2 Dr. B. Pal, Director, Indian Agricultural Research Institute, New Delhi
3 Dr. K. C. Naik, Principal, Agricultural College and Research Institute, Coimbatore, Madras State
4 Dr. M. B. Ghatge, Agricultural Marketing Adviser to the Govt. of India, P. Block, New Delhi
5 Shri V. M. Srikumarana Nair, Dy. Chief Controller of Imports and Exports, Ministry of Commerce & Industry, Government of India, New Delhi
6 Director of Agriculture, Govt. of Kerala, Trivandrum
7 Director of Agriculture, Govt. of Mysore, Bangalore
8 Director of Agriculture, Govt. of Madras, Chepauk, Madras
9 Director of Agriculture, Govt. of Madhya Pradesh, Bhopal
10 Director of Agriculture, Andhra Pradesh, Guntur
11 Addl. Director of Agriculture, Assam, Shillong
12 Director of Agriculture, Orissa, Cuttack
13 Director of Agriculture, Govt. of Bombay, Bombay
14 Director of Agriculture, Govt. of West Bengal, Calcutta
15 Add. Development Commissioner, Govt. of Kerala, Trivandrum
16 Development Commissioner, Govt. of Mysore, Bangalore
17 Chief Conservator of Forests, Madras
18 Development Commissioner, Govt. of Andhra Pradesh, Hyderabad
19 Development Commissioner, Govt. of Madhya Pradesh, Bhopal
20 Dy. Development Commissioner (Community Project), Govt. of Assam, Shillong
21 Shri K. V. Thomas, Sea View Estate, Mandakayam, Kerala
22 Shri M. Hammed, C/o M/s Makkar Pillai & Sons, Alwaye, Kerala
23 Shri K. N. P. Zantye, Malvan District, Ratnagiri, Bombay State
24 Shri S. Narasapaya, B. A., B.L., Member, Legislative Council, Mangalore-3
25 Mr. M.H. Fowler, C/o M/s Peirce Leslie & Co. Ltd. Alleppey
26 Shri V. J. Joseph C/o M/s Pothen Joseph & Sons Ltd., Alleppey
27 Chief Conservator of Forests, Govt. of Kerala, Trivandrum
28 Cashew & Spices Development Officer, Crystal Cottage, Thewara Road, Ernakullam
29 Chief Conservator of Forests, Govt. of Mysore, Bangalore
30 Chief Conservator of Forests, Government of Andhra Pradesh, Hyderabad.
31 Chief Conservator of Forests, Government of Madhya Pradesh, Bhopal
32 Chief Conservator of Forests, Government of W. Bengal, Calcutta
33 Chief Conservator of Forests, Govt. of Bombay, Bombay
34 Chief Conservator of Forests, Government of Assam, Shillong

APPENDIX XII—*contd.*

**AGRICULTURAL ENGINEERING COMMITTEE**

*Members by Name*

1 Shri D. A. Gadkari (Chairman), Officer on Special Duty, Political and Service Deptt., Sachivalaya, Bombay-1

2 Shri A. A. Menon, Agricultural Engineer to Govt. of Bombay, Poona-5

3 Shri C. P. Raju, Headquarters Agricultural Engineer, Office of the Director of Agriculture and Fisheries, Andhra Pradesh

4 Shri B. N. Banerjee, Joint Director of Agricultural Engineering, West Bengal, Calcutta

5 Shri H. N. Bhattacharya, Agricultural Engineer, Assam, Gauhati

6 Shri A. Pandya, Assistant Professor of Agricultural Engineering (Farm Power Machinery), Deptt. of Agricultural Engineering, Indian Institute of Technology, Kharagpur, S.E. Rly.

7 Shri P. L. Goel, Divisional Engineer (S), C.T.O., New Pusa, New Delhi

8 Shri B. S. Kumar, Agricultural Engineer to the Govt. of Madhya Pradesh, Rewa

9 Shri C. S. Iyer, Agricultural Engineer (E. Wing), Agricultural Department, Ludhiana

10 Shri H. V. Bhargav, Agricultural Engineer, C/o Director of Agriculture, U. P. Lucknow

11 Dr. M. P. Singh, Agricultural Engineer (Research), Bihar, Patna

12 Shri V. Subba Raju, Head of the Div. of Agril. Engineering, Indian Institute of Technology, Khargpur (S. E. Rly.)

13 Shri S. K. Paul, Agricultural Engineer (Implements), Ludhiana, Punjab

*Representatives of Firms*

14 Shri P. L. Kirloskar, Purchasing Officer, Kirloskar Wadi, Distt. South Satara

15 Shri G. R. Damodaran, Director, P.S.G. & Sons, Charity Industrial Institute, Peelamedu P.O., Coimbatore (S. India)

16 Shri G. A. Rao, Business Director, Vijayawada-2

17 Shri S. K. Kempaina, General Manager, The Mysore Implements Factory (Govt. of Mysore), P. O. Hessan

18 Shri Thampi Thomas, Community Project Officer (Industries), The Industrial Cooperative Society, Neyyattinkara (Kerala State)

*Ex-officio Members*

1 Shri J.S. Manku, Officer-in-charge, Div. of Agril. Engineering, I.A.R.I., New Delhi

2 Shri D. N. Khadakar, Agril. Engineer, Dte. of Extension and Training, Min. of Agri., Govt. of India, New Delhi

3 Shri Mahavir Prasad, Irrigation Adviser, Ministry of Agriculture, Govt. of India, New Delhi

4 Shri I.S. Ghulati, Dy. Development Officer, Office of the Development Commissioner, Small Scale Industries, 114, Sundernagar, New Delhi

5 Dr. B. P. Pal, Director, I.A.R.I., New Delhi

6 Shri E. G. K. Rao, Head of the Div. of Agril. Engineering, I.A.R.I., New Delhi

APPENDIX XII—*contd.*

**ENTOMOLOGY AND ANIMAL PESTS ON CROPS COMMITTEE**

1 Dr. P. J. Deoras, Assistant Director, Incharge, Department of Entomology, Haffkine Institute, Bombay-12

2 Dr. H. S. Pruthi, Punjab University College, Hoshiarpur

3 Shri V. Thirmal Rao, Adviser in Plant Protection, C/o The Mysore Insectionates Co., 31-A, North Beach Road, Madras

4 Dr. G. A. Patel, Entomologist to Government of Bombay, Agriculture College, Poona-5

5 Dr. R. L. Gupta, Entomologist to Government of Madhya Pradesh, College of Agriculture, Nagpur

6 Dr. Mohammad Qadiruddin Khan, Entomologist to Government of Hyderabad, Main Farm, Himayatsagar, Hyderabad-Dn.

7 Dr. A.C. Sen, Regional Director, Agricultural Research Institute, Patna

8 Dr. S.N. Banerjee, Entomologist to Government of West Bengal, 230, Netaji Subhash Road, Tollyganj, Calcutta

9 Dr. Sardar Singh, Entomologist to Government of Punjab, Ludhiana

10 Dr. A.S. Srivastava, Entomologist to Government of Uttar Pradesh, Kanpur

11 Shri K. P. Anatanarayanan, No. 58, Venkataswamy Road, R. S. Puram P.O.. Coimbatore

12 Dr. M. Puttaradiah, Entomologist to Government of Mysore

13 Dr. R.N. Mathur, Chief Research Officer, Forest Research Institute, New Delhi

*Ex-officio Members*

1 Dr. K. B. Lal, Plant Protection Adviser to the Government of India, Directorate of Plant Protection, Quarantine and Storage, Ministry of Food and Agriculture, Government of India, New Delhi

2 Shri K.R. Sentakay, Director of Storage, Directorate General of Food, Ministry of Food and Agriculture, Government of India, New Delhi

3 Dr. E. S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi

4 Dr. M.L. Roonwal, Director, Zoological Survey of India, 34, Chittaranjan Avenue, Calcutta-1

5 Dr. B.P. Pal, Director, I.A.R.I., New Delhi.

**SOIL SCIENCE COMMITTEE**

*Members by Name*

1 Dr. P.K. Dey, Principal and Professor of Chemistry, College of Agriculture, Rani Kutir, Calcutta 40

2 Dr. H. N. Mukherjee, Principal, Agricultural College, Govt. of Bihar, Ranchi

3 Dr. V. Subrahmanyan, Director, Central Food Technological Research Institute, P.O. V. V. Mohala, Mysore

4 Dr. H. L. Uppal, Director, Irrigation and Power Research Station, Punjab, Amritsar

APPENDIX XII—*contd.*

5 Dr. J. V. Baat, Asstt. Professor of Fermentation, Technology Laboratory, Indian Institute of Science, Bangalore-3

6 Dr. A. D. Desai, Deputy Director of Agriculture, Government of Mysore, Bangalore

7 Dr. R. R. Agarwal, Agricultural Chemist to Government of Uttar Pradesh, Kanpur

8 Dr. N. Narayan, Agricultural Chemist, Government of Bombay State, Poona

9 Shri S. S. Sirur, Agricultural Chemist, Government of Mysore, Bangalore

10 Dr. A. N. Puri, Director, Field Research Station, 10, Sussex Road, Bombay-27

11 Dr. C. C. Shah, 15, Queens Garden, Poona-1

12 Dr. S. K. Bhattacharaya, Professor of Chemistry, Indian Instt. of Technology, Kharagpur (West Bengal)

13 Dr. S. D. Nijhawan, 338, Model Town, Ludhiana

14 Dr. A. Mariakulandai, Govt. Agril. Chemist, Agril. College and Research Institute, Lawley Road, P.O. Coimbatore

15 Dr. S.V. Govindarajan, Soil Correlator, All India Soil Survey Scheme, V Block, Kumara Part West Extension, Bangalore-3

16 Shri D. V. Krishna Rao, Agricultural Chemist, Agricultural College, Bapatla, Andhra

17 Dr. J. A. Daji, 384, Bhawani Path, Moden Colony, Poona

18 Dr. Jaswant Singh Kanwar, Agri. Chemist, Ludhiana, Punjab

*Ex-officio Members*

1 Dr. S. P. Raychaudhuri, Head of the Division of Soil Science and Agricultural Chemistry, I.A.R.I., New Delhi

2 Dr. J.K. Basu, Director of Soil Conservation Control, Soil Conservation Board, Ministry of Agri., New Delhi

3 Soil Conservation Officer, Dehra Dun

4 Dr. R.C. Hoon, Director, Central Water and Power Commission, Bikaner House, New Delhi

5 Shri R.P. Talati, Compost and Sewage Devt. Office, Ministry of Agriculture, New Delhi

6 Dr. B. P. Pal, Director, Indian Agricultural Research Instt., New Delhi

**AGRONOMY COMMITTEE**

*Members by Name*

1 Dr. R. K. Tandon, Principal, Government Agricultural College, Kanpur

2 Dr. T. J. Mirchandani, Director, Agronomic Survey and Experimentation, I.C.A.R., New Delhi

3 Shri K. L. Khana, Director, Sugarcane Research, Pusa, Bihar

4 Dr. L. A. Ramdas, Head of the Division of Heat and Power, National Physical Laboratory, Hillside Road, New Delhi

5 Dr. V. G. Vaidya, Joint Director of Agriculture, Central Building, Poona-1

APPENDIX XII—*contd.*

6 Shri H. R. Saini, House No. E. S. 55, Near Supdt. Police Office, Civil Lines, Jullunder City

7 Dr. N. K. Anant Rao, Deputy Director and Incharge Agricultural Centre, Balwant Vidyapeeth Rural Institute, P. O. Bichpuri, Agra

8 Shri P.A. Venketeswaran, Director of Agriculture, Madras (Govt.), 13/85, Pannuranjam Road, R. S. Puram, Coimbatore

9 Dr. B. A. Chaugule, Professor of Agronomy, College of Agriculture, Poona

10 Shri P. L. Patel, Manekpore, P.O., Manekpore, via. Madhi, T. V. Rly., Taluka Bardoli, Distt. Surat, Bombay State

11 Dr. L. C. Sikka, Dairy Development Adviser, Ministry of Agriculture, New Delhi

12 Dr. Mukhtar Singh, Agronomist, I.A.R.I., New Delhi

13 Shri A. T. Sanyal, Professor of Agronomy, Govt. Agrl. College, Rani Kutir, Tollygunj, Calcutta

14 Dr. J. A. Daji, 284, Bhawani Peth, Madon Colony, Poona-2

*Ex-officio Members*

1 Dr. B. P. Pal, Director of Indian Agricultural Research Institute, New Delhi

2 Dr. P. C. Raheja, Head of the Division of Agronomy, I.A.R.I., New Delhi

3 Dr. R. D. Asana, Division of Botany, Indian Agricultural Research Institute, New Delhi

4 Head of the Division of Animal Nutrition, I.V.R.I., Izatnagar

**ANIMAL NUTRITION COMMITTEE**

*Subject*—All aspects of Animal Nutrition

*Members by Name*

1 Dr. N. D. Kehar, Head of the Division of Animal Nutrition, Indian Veterinary Research Institute, Izatnagar

2 Dr. K. C. Sen, 11-A Southern Avenue, Calcutta-26

3 Shri V. Mahadevan, Professor of Animal Nutrition, Madras Veterinary College, Madras-7

4 Dr. Lal Chand Dharmani, Retired Agricultural Chemist, Anandpur Sahib, Via Sirhind, Rupar (N. Railway)

5 Dr. S. K. Talpatra, Professor of Animal Nutrition, U.P. College of Veterinary Science and Animal Husbandry, Mathura

6 Agrostologist, Indian Agricultural Research Institute, New Delhi

7 Shri H. R. Saini, House No. E. H. 55, near Supdt. Police's Office, Civil Lines, Jullunder City

8 Shri B. K. Das, M. Sc., Physiological Chemist, Assam, Gauhati

9 Dr. R. L. Kaura, Prem Bhavan, Clement Town, Dehra Dun

APPENDIX XII—*contd.*

*Members by Designation*

10 Central Silviculturist, Forest Research Institute, Dehra Dun

11 Dr. Balkrishna Mohanlal Patel, R. O., Officer-in-charge, Anand Regional Animal Nutrition Research Centre, Institute of Agriculture, Anand

12 Dr. Radhavallav Chanda, Officer-in-charge, Eastern Regional Animal Nutrition Centre, Haringhata Farm, Haringhata, P. O. Mohanpur, District Nadia (West Bengal)

13 Dr. M. L. Mathur, Officer-in-charge, Southern Regional Animal Nutrition Centre, National Dairy Research Institute, Bangalore

14 The Animal Nutrition Officer, Animal Husbandry Department, Govt. of Orissa, Cuttack

15 Dr. P. C. Raheja, Head of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi

**ANIMAL BREEDING COMMITTEE**

*Subject*—All aspects of Animal Breeding

*Members by Name*

1 Shri K. J. Devadanam, Deputy Director (Animal Husbandry) Andhra Pradesh, Hyderabad

2 Shri S. K. Sen, Director of Animal Husbandry, Bihar, Patna

3 Shri B. G. Oka, C/o Cattle Development Officer, Bombay State, Poona

4 Shri M. Dharmarajan, Professor of Animal Genetics, Madras Veterinary College, Madras

5 Shri G. B. Singh, Director of Animal Husbandry & Veterinary Services, Orissa, Cuttack

6 Shri B. N. Handa, Director of Veterinary & Animal Husbandry, Rajasthan, Jaipur

7 Shri H. B. Shahi, Animal Husbandry Commissioner and Ex-Officio Additional Secretary to Government, Animal Husbandry Department, U. P., Lucknow

8 Shri R. B. Singh, Professor of Animal Genetics, U.P. College of Veterinary Science and Animal Husbandry, Mathura

9 Dr. P. Bhattacharya, Head of the Division of Animal Genetics, Indian Veterinary Research Institute, Izatnagar

10 Shri S. G. Iyer, Head of the Division of Poultry Research, Indian Veterinary Research Institute, Izatnagar

11 Dr. M. D. Patel, Director, Institute of Agriculture, Anand

12 Dr. O. B. Tandon, Head of the Animal Husbandry Department, Allahabad Agricultural Institute, P.O. Agricultural Institute, District Allahabad

13 Dr. R. L. Kaura, Prem Bhawan, Clement Town, Dehra Dun

14 Shri Bishan Mansingh, Civil Lines, Fatehpur (U.P.)

15 Dr. Zal R. Kothavalla, 8, Ali Asker Road, Bangalore

APPENDIX XII—*contd.*

16 Dr. S. M. Sikka, Head of the Division of Botany, Indian Agricultural Research Institute, New Delhi

17 Dr. T. R. Mehta, Principal, Agricultural College, & Jt. Director of Agriculture, Madhya Pradesh, Gawalior

*Members by Designation*

18 The Director, Remounts Veterinary & Farms (or his representative) Quarter Master General's Branch, Army Headquarters, New Delhi

19 The Superintendent, Government Livestock Farm, Hissar

20 The Superintendent (FARM), National Dairy Research Institute, Karnal

*Ex-officio Members*

1 The Chairman, Cross-Breeding Committee

2 The Chairman, Poultry Committee

3 The Chairman, Goat, Sheep & Wool Committee

4 Officers of the Council

**CROSS BREEDING COMMITTEE**

*Subject*—All aspects pertaining to cross-breeding of cattle

*Members by Designation*

1 The Animal Husbandry Commissioner with the Government of India New Delhi—Chairman

2 The Statistical Adviser (in his absence the Statistician, Animal Husbandry), Indian Council of Agricultural Research, New Delhi

3 The Director Remounts, Veterinary & Farms (or his representative), Quarter Master General's Branch, Army Headquarters, New Delhi

4 The Head of the Division of Animal Genetics, Indian Veterinary Research Institute, Izatnagar

5 The Deputy Livestock Adviser to the Government of India, Indian Council of Agricultural Research, New Delhi—(Secretary)

*Members by Name*

6 Dr. L. C. Sikka, Dairy Development Adviser, Ministry of Food and Agriculture, Department of Agriculture, New Delhi

7 Lt. Col. T. Murari, No. 1/2 Landans' Road, Kilapauk, Madras-10

**ANIMAL DISEASE AND PESTS COMMITTEE**

*Subject*—Pathology, Parasitology, Toxicology, Pharmaceutics, Physiology, Medicinal Surgery etc.

*Members by Name*

1 Shri V. R. Rajgopalan, Director, Livestock Research Station, P.O. Bihar Veterinary College, Patna

2 Shri S. R. Chadha, Director of Veterinary Services, Bombay State, Poona

3 Shri M. Y. Mangrulkar, Principal, Madhya Pradesh, Veterinary College, Jubbulpore

APPENDIX XII—*contd.*

4 Shri G. S. Thapar, Mahatma Gandhi Marg, Lucknow

5 Shri R. L. Kaushal, Principal, Madhya Bharat Veterinary College, Mhow

6 Dr. H. D. Srivastava, Head of the Division of Parasitology, Indian Veterinary Research Institute, Izatnagar

7 Shri M. R. Dhanda, Head of the Division of Bacteriology and Pathology, Indian Veterinary Research Institute, Mukteswar

8 Shri K. S. Shetty, Director of Animal Husbandry & Veterinary Services, Mysore State, Bangalore

9 Dr. H. N. Ray, Professor of Protozoology, School of Tropical Medicine, Chitranjan Avenue, Calcutta

10 Dr. C. Krishna Rao, Deputy Director of Animal Husbandry, Andhra Pradesh, Hyderabad

11 Dr. S. Dutta, 12/2 Old Belly Ballygunge, Second Lane, Calcutta

12 Shri B. N. Soni, Research Officer, Hides and Skins, Indian Veterinary Research Institute, Izatnagar

13 Shri G. L. Sharma, Research Officer, (Pathology) I.V.R.I., Mukteswar (U.P.)

14 Director, Indian Veterinary Research Institute, Izatnagar

15 The Research Officer, (Entomology), Indian Veterinary Research Institute, Izatnagar

16 The Director, Remounts, Veterinary and Farms, Army Head Quarters, New Delhi

17 The Director, Central Leather Research Institute, Madras

**AD HOC COMMITTEE ON PARASITOLOGY OF CATTLE**

1 Dr. H. D. Srivastava, D.Sc., Head of the Division of Parasitology, Indian Veterinary Research Institute, Izatnagar, U.P.

2 Shri Anantaraman, M.A., M.Sc., F.L.S., Helminthiasis Research Officer, Madras Veterinary College, Madras

3 Dr. N. S. Krishna Rao, B.A., L.V.P., Ph.D., Parasitologist, Mysore Serous Institute, Hebbel (Mysore)

4 Shri P. K. Sinha, G.B.V.C., M.Sc., Assistant Professor of Parasitology, West Bengal Veterinary College, Calcutta

5 Dr. H. R. Mehra, Ph.D., Retired Professor of Zoology, University of Allahabad, 33, Chatham Lines, Allahabad

6 Shri Karam Chand, L.V.P., Professor of Parasitology, Camp Veterinary College, Hissar

7 Dr. A. K. Verma, G.B.C.C. Ph., Research Officer, Livestock Research Section, Bihar, P.O. Bihar Veterinary College, Patna

8 Shri M. R. Mahajan, M.R.C.V.S., Livestock Development Adviser, Ministry of Food & Agriculture, New Delhi

9 Dr. B. P. Pande, Professor of Parasitology, U.P. College of Veterinary Science & Animal Husbandry, Mathura

APPENDIX XII—*contd.*

**POULTRY COMMITTEE**

*By Name*

1 Shri S. G. Iyer, Head of the Division, Poultry Research, Indian Veterinary Research Institute, Izatnagar (U.P.)

2 Shri R. M. Patil, Poultry Development Officer, Bombay, Poona

3 Shri P. C. Thomas, Poultry Development Officer, Government Poultry Farm, Manunuthi, Trichur, Kerala State

4 Shri S. A. Prasad, President, Andhra Poultry Association, P.O. Nandigama, Distt. Krishna, Andhra Pradesh

5 Major G. C. Juneja, Director of Veterinary & Animal Husbandry Services, Madhya Pradesh, Rewa

6 Shri B. M. Prasad, Deputy Director of Animal Husbandry, North Bihar Ranges, Muzaffarpur

7 Principal, American Arcot Mission, Agriculture Institute, Katpadi

*By Designation*

8 Representative of Community Project Area (Shri P. M. N. Naidu)

9 Poultry Development Officer, Madras

10 Poultry Development Officer, Orissa, Cuttack

*Ex-officio*

11 Dr. S. Bose, Research Officer, Poultry Division, Indian Veterinary Research Institute, Izatnagar (U.P.)

**DAIRY SCIENCE COMMITTEE**

*Members by Name*

1 Dr. Z. R. Kothavalla, No. 8, Ali Askar Road, Bangalore

2 Shri G. S. Godbole, Dairy Development Officer, Bombay State, Poona

3 Shri N. K. Bhargava, Dairy Development Officer, Cooperative Department, U. P., Lucknow

4 Shri D. N. Khurody, Dairy Development Commissioner & Joint Secretary, Government of Bombay, Old Secretariat, Bombay-1

5 Professor James N. Warner, Head of Dairy Department, Allahabad Agricultural Institute, P.O. Agricultural Institute, District Allahabad

6 Shri V. Kurion, Manager, Kaira District, Cooperative Milk Producers' Union, Ltd., Anand (Bombay)

7 Col. T. Murari, 1/2 Landan's Road, Kilpauk, Madras

8 Shri N. Srirama Reddy, President, Mysore Dairymens' Association, The Model Dairy Farm, "Rango Gowd" Buildings, Madhavanagar, High Grounds, Bangalore-1

9 Dr. K. C. Sen, 11-A, Southern Avenue, Kalighat P.O. Calcutta-26

*Members by Designation*

10 The Director of Remounts, Veterinary & Farms, Quarter Mastre General's Branch, Army-Headquarters, New Delhi

APPENDIX XII—*contd.*

11 The Dairy Development Adviser to the Government of India, Ministry of Agriculture (Deptt. of Agri.), New Delhi

12 The Dairy Husbandry Officer, National Dairy Research Instt., Karnal (Punjab)

13 The Director of Dairy Research, National Dairy Research Institute Karnal (Punjab)

14 The Dairy Chemist, National Dairy Research Institute, Karnal (Punjab)

15 The Dairy Bacteriologist, National Dairy Research Institute, Karnal (Punjab)

16 The Dairy Technologist, National Dairy Research Institute, Karnal (Punjab)

17 The Milk Commissioner, West Bengal, Writers Buildings, Calcutta

*Ex-officio Members*

Officers of the Council

**GOAT, SHEEP AND WOOL COMMITTEE**

*By Name*

1 Shri S. S. Khot, Liaison Officer (Sheep and Wool), I.C.A.R., New Delhi

2 Dr. C. Nanjundayya, Director, Technological Laboratory, Indian Central Cotton Committee, Adenwala Road, Mutunga, Bombay-19

3 Shri B. K. Vaidya, Assistant Director, Textile Research Institute, Ahmedabad Textile Industry's Research Association, Naverangpura, Ahmedabad

4 Shri B. K. Sinha (Representative of the Wool Merchant's Association), 6A/58, Western Extension Area, Karol Bagh, New Delhi

5 Shri S. V. Sathe, Representative, Khadi and Village Industries Commission, Mistry Bhavan, Dinshaw Watchha Road, Bombay-1

6 Shri N. L. Narayana, Deputy Director, Sheep & Wool, Government of Rajasthan, Bikaner

7 Shri Manoobhai Doongursee, C/o Doongursee and Sons, Maneckji Wadia Building, 107, Mahatma Gandhi Road, Fort, Bombay-1

8 Shri H. K. Lall, Deputy Director, Animal Husbandry Department, Lucknow, Uttar Pradesh

9 Sardar Gurbax Singh Mahal, Research Officer, Sheep Research Station, Government Livestock Farm, Hissar

10 Shri E. B. Whitley, Director, International Wool Secretariat, Hamilton House, Post Box 451, Connaught Place, New Delhi

11 Shri V. N. Kak, Vice-President, Progressive Farmers' Association, Rajasthan, Jaipur

12 Two Representatives of the All India Wool Traders' Federation, Post Box No. 1051 Bombay-1. (New representatives are nominated by the Federation of each of the meetings of the Committee)

APPENDIX XII—*contd.*

*By Designation*

13 Shri S. A. Teckchandani (Representative of Ministry of Commerce and Industry), Deputy Secretary to the Government of India, Ministry of Commerce and Industry, New Delhi

14 Shri H. S. Bawa, Senior Marketing Officer, The Agricultural Marketing Adviser to the Government of India, New Delhi

15 The Director, Indian Standards Institution, Civil Lines, Delhi-8

16 Dr. P.M.N. Naidu, Adviser Animal Husbandry, Representative of Community Development, Government of India, New Delhi

**AGRICULTURAL ECONOMICS COMMITTEE**

*Members by Name*

1 Dr. P. S. Lokanathan, Director General, National Council of Applied Economic Research, 48/48, Chanakyapuri, New Delhi

2 Shri Manilal B. Nanavati, President, Indian Society of Agricultural Economics, 46-48 Esplanade Mansion, Mahatma Gandhi Road, Bombay-1

3 Dr. G. D. Aggarwal, Production Economist, Directorate of Economics & Statistics, New Delhi

4 Prof. J. J. Anjaria, Economic Adviser, Deptt. of Economic Affairs, Ministry of Finance, Govt. of India, New Delhi

5 Prof. C. N. Vakil, Director, UNESCO Research Centre, P. O. Box No. 242, Calcutta

6 Prof. D. G. Karve, Summer Queen, Arthur Bunder Road, Colaba, Bombay-6

7 Dr. D. R. Gadgil, Gokhale Institute of Politics and Economics, Poona

8 Dr. U.P. Niyogi, University Prof. of Economics and Head of the Deptt. of Economics, University College of Arts and Commerce, Ashutosh Building, Calcutta

9 Dr. B. N. Ganguli, Director, Delhi School of Economics, University of Delhi, Delhi-8

10 Prof. M. L. Dantwala, Prof. of Agricultural Economics, University of Bombay, Bombay

11 Dr. Jaswant Singh, Principal and Irwin Prof. of Agriculture, College of Agriculture, Banaras Hindu University, Banaras, U.P.

12 Shri S. K. Bedkar, Deputy Director of Agriculture (Headquarters Bombay State) Poona

13 Dr. Arjan Singh, Director of Agriculture, Punjab, Chandigarh

14 Shri Sachin Chaudhuri, Editor, 'Economic' Weekly, 15, Tamarind Lane, Bombay-1

15 Dr. S. R. Chadha, Director of Veterinary Services, Bombay State, Poona

16 Shri M. P. Gandhi of M.P. Gandhi & Co., Jan Mansions, Sir Pherozeshah Mehta Road, Fort, Bombay

APPENDIX XII—*concld.*

*Ex-officio Members*

1 The Economics & Statistical Adviser, Directorate of Economics and Statistics, Ministry of Agricluture, New Delhi

2 The Agricultural Marketing Adviser to the Government of India, Directorate of Marketing & Inspection, Ministry of Agriculture, New Delhi

3 The Agricultural Commissioner with the Government of India, I.C.A.R., New Delhi

4 The Statistical Adviser, I.C.A.R., New Delhi

5 Director, I.A.R.I., New Delhi

6 The Secretary, Research Programme Committee, Planning Commission, Government of India, New Delhi

7 Dy. Economic and Statistical Adviser and Director (Planning) Ministry of Food and Agriculture (Shri J. S. Sarma).

**STATISTICAL COMMITTEE**

*Members by Name*

1 Dr. K. Kishen, Chief Statistician to the Government of U. P., Department of Agriculture, Chhota Chutter Manzil, Lucknow

2 Dr. G.R. Rao, Prof. & Head of the Division of Research & Training, Indian Statistical Institute, 203, Barrackpore Trunk Road, Calcutta-35

3 Shri A. A. Rau, State Statistician for Mysore Vidhan Soudha, Bangalore

4 Dr. N. S. R. Sastry, Director of Statistics, Reserve Bank of India, Bombay

5 Dr. K. R. Nair, Statistician, Forest Research Institute & College, P.O. New Forest, Dehradun

6 Dr. U. S. Nair, Prof. of Statistics, Statistical Laboratory, University of Travancore-Cochin, Trivandrum

7 Dr. P. K. Bose, Head of the Department of Statistics, Calcutta University, Calcutta

8 Shri M. V. Divetia C/o Council of Applied Economic Research, Bombay Mutual Building, Parliament Street, New Delhi

9 Shri Ranga Rao, Statistician, Department of Agriculture, Bombay State, Poona

*Ex-officio Members*

1 Statistical Adviser, Indian Council of Agricultural Research, New Delhi

2 The Economic & Statistical Adviser, Directorate of Economics & Statistics, Ministry of Food and Agriculture, New Delhi

3 The Agricultural Marketing Adviser to the Government of India, New Delhi

4 The Joint Director, Central Statistical Organisation, New Delhi

5 Dr. P. C. Raheja, Head of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi

APPENDIX XIII

## REGIONAL COMMITTEES ON ANIMAL HUSBANDRY SIDE

### TEMPERATE REGIONAL COMMITTEE

1 The Animal Husbandry Commissioner with the Government of India —(Chairman)
2 The Director, Indian Veterinary Research Institute, Izatnagar
3 The Director, Animal Husbandry & Veterinary Department, Assam, Gauhati
4 The Director of Animal Husbandry & Warden of Fisheries, Punjab, Simla
5 The Director of Animal Husbandry, Uttar Pardesh, Lucknow
6 The Director of Animal Husbandry, Jammu & Kashmir, Srinagar
7 The Chief Conservator of Forests, Himachal Pradesh, Simla
8 The Deputy Director of Animal Husbandry, Himachal Pradesh, Simla
9 The Director of Agriculture, West Bengal, Calcutta
10 The Director Veterinary & Animal Husbandry Services, West Bengal, Calcutta
11 A Representative of the Farmers' Forum of India
12 The Chairman, Animal Breeding Committee
13 The Chairman, Crossbreeding Committee } Shri L. Sahai, A.H.C.
14 The Chairman, Animal Diseases & Pests Committee
15 The Chairman, Animal Nutrition Committee—Dr. N.D. Kehar, Director, I.V.R.I., Izatnagar
16 The Chairman, Poultry Committee— Shri S.G. Iyer, Head of the Division of Poultry Research, I.V.R.I., Izatnagar
17 The Chairman, Dairy Science Committee—Dr. L. C. Sikka, Dairy Development Adviser, Ministry of Food & Agriculture, New Delhi
18 The Chairman, Agriculture Committee—Dr. E.S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi
19 The Chairman, Goat, Sheep & Wool Committee—Shri S.S. Khot, Liaison Officer (Sheep & Wool) I.C.A.R., New Delhi

### NORTHERN REGIONAL COMMITTEE

1 The Animal Husbandry Commissioner with the Government of India —(Chairman)
2 The Director, Indian Veterinary Research Institute, Izatnagar
3 The Director of Animal Husbandry, Bombay, Poona
4 The Director of Animal Husbandry & Warden of Fisheries, Punjab, Simla
5 The Director of Animal Husbandry, Uttar Pradesh, Lucknow
6 The Director of Veterinary & Animal Husbandry Services, Madhya Pradesh, Rewa
7 The Director of Veterinary & Animal Husbandry, Rajasthan, Jaipur

APPENDIX XIII—*contd.*

8 The Director, Institute of Agriculture, Anand (Western Railway)

9 The Director of Dairy Research, National Dairy Research Institute, Karnal

10 The Assistant Director, Animal Husbandry Department, New Delhi

11 The President, Tanners' Federation of India, Kanpur

12 A Representative of the Farmers' Forum of India

13 The Chairman, Animal Breeding Committee
14 The Chairman, Crossbreeding Committee
15 The Chairman, Animal Diseases & Pests Committee
} Shri L. Sahai, A.H.C.

16 The Chairman, Animal Nutrition Committe—Dr. N.D. Kehar, Director, I.V.R.I., Izatnagar

17 The Chairman, Poultry Committee—Shri S.G. Iyer, Head of the Division of Poultry Research, I.V.R.I., Izatnagar

18 The Chairman, Dairy Science Committee—Dr. L.C. Sikka, Dairy Development Adviser, Ministry of Food & Agriculture, New Delhi

19 The Chairman, Apiculture Committee—Dr. E.S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi

20 The Chairman, Goat, Sheep & Wool Committee—Shri S. S. Khot, Liaison Officer (Sheep & Wool) I.C.A.R., New Delhi.

**EASTERN REGIONAL COMMITTEE (INCLUDING COASTAL REGION)**

1 The Animal Husbandry Commissioner with the Govt. of India—Chairman

2 The Director of Animal Husbandry & Fisheries, Andhra Pradesh, Hyderabad

3 The Director of Animal Husbandry & Veterinary Department, Assam, Gauhati

4 The Director of Animal Husbandry, Bihar, Patna

5 The Director of Animal Husbandry, Bombay, Poona

6 The Director of Veterinary & Animal Husbandry Services, Madhya Pradesh, Rewa

7 The Director of Animal Husbandry, Madras, 15 Marshall's Road, Madras-8

8 The Director of Animal Husbandry & Veterinary Services, Orissa, Cuttack

9 The Director of Animal Husbandry, Uttar Pradesh, Lucknow

10 The Director of Veterinary Services & Animal Husbandry, West Bengal, Calcutta

11 The Director of Agriculture, West Bengal, Calcutta

12 The Director of Animal Husbandry, Kerala, Trivandrum

13 The Director of Animal Husbandry & Veterinary Services, Mysore, Bangalore

14 The Director of Agriculture (Animal Husbandry & Veterinary), Manipur, Imphal

APPENDIX XIII—*contd.*

15 The Animal Husbandry Officer, Tripura, Agartala

16 The Principal, Allahabad Agricultural Institute, P. O. Agricultural Institute, Distt. Allahabad

17 Representative of the Calcutta Hides & Skins Shippers' Association, Royal Exchange, Calcutta

18 Representative of the Farmers' Forum of India

19 The Chairman, Animal Breeding Committee
20 The Chairman, Crossbreeding Committee
21 The Chairman, Animal Diseases & Pests Committee } Shri L. Sahai, A.H.C.

22 The Chairman, Animal Nutrition Committee—Dr. N.D. Kehar, Director I.V.R.I., Izatnagar

23 The Chairman, Poultry Committee— Shri S. G. Iyer, Head of the Division of Poultry Research, IVRI, Izatnagar

24 The Chair, Dairy Science Committee— Dr. L. C. Sikka, Dairy Development Adviser, Ministry of Food & Agriculture, New Delhi

25 The Chairman, Apiculture Committee—Dr. E. S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi

26 The Chairman, Goat, Sheep & Wool Committee— Shri S.S. Khot, Liaison Officer (Sheep &'Wool) I.C.A.R., New Delhi

**SOUTHERN REGIONAL COMMITTEE**

1 The Animal Husbandry Commissioner with the Government of India —Chairman

2 The Director, Indian Institute of Science, Bangalore

3 The Director of Animal Husbandry & Fisheries, Andhra Pradesh, Hyderabad

4 The Director of Animal Husbandry, Bombay, Poona

5 The Director of Animal Husbandry, Madras, 15 Marshall's Road Madras 8

6 The Director of Animal Husbandry & Veterinary Services, Mysore. Bangalore

7 Representative of the All-India Khadi & Village Industries Commission, Bombay

8 Representative of the Farmers' Forum of India

9 The Chairman, Animal Breeding Committee
10 The Chairman, Crossbreeding Committee
11 The Chairman, Animal Diseases & Pests Committee } Shri L. Sahai, A.H.C.

12 The Chairman, Animal Nutrition Committee—Dr. N.D. Kehar, Director I.V.R.I., Izatnagar

13 The Chairman, Poultry Committee—Shri S. G. Iyer, Head of the Division of Poultry Research, I.V.R.I., Izatnagar

14 The Chairman, Apiculture Committee—Dr. E.S. Narayanan, Head of the Division of Entomology, I.A.R.I., New Delhi

15 The Chairman, Goat, Sheep & Wool Committee—Shri S. S. Khot, Liaison Officer (Sheep & Wool), I.C.A.R., New Delhi

APPENDIX XIV

## COMMODITY COMMITTEES

### RICE COMMITTEE

*Chairman*—Agricultural Commissioner with the Government of India, Indian Council of Agricultural Research, New Delhi.

*Members*

1 Secretary, Indian Council of Agricultural Research, New Delhi
2 Director, Indian Agricultural Research Institute, New Delhi
3 Director, Central Rice Research Institute, Cuttack
4 Director, Central Food Technological Research Institute, Mysore
5 Agricultural Extension Commissioner with the Government of India, New Delhi
6 Agricultural Marketing Adviser to the Government of India, New Delhi
7 Economics and Statistical Adviser, Ministry of Food and Agriculture, Department of Agriculture, New Delhi
8 Dr. P. K. Kymal, Technical Adviser, Department of Food, Ministry of Food and Agriculture, New Delhi
9 Agricultural Adviser, Ministry of Community Development, Government of India, New Delhi
10 Shri Rama Iyer, Deputy Development Officer, Development Wing, Ministry of Commerce and Industry, New Delhi
11 Dr. T. S. Gill, Asstt. Chief (Agriculture Division), Planning Commission, New Delhi
12 Shri K.D. Sharma, Secretary, Farmers' Forum (India), Jawahar Mall Mansion, Ajmeri Gate Extension, New Delhi
13. Directors of Agriculture of all States and Union Territories
14 Shri Ashutosh Bhattacharya, 30, Kabir Road, Calcutta
15 Messrs. Maman Chand Radha Kishan, Bankers, Commission Agents and Mill Owners, Shivaji Bazar, Saharanpur, Uttar Pradesh
16 S. Satwant Singh, Nasirpur farm, Bahadur Garh Fort, Patiala
17 Shri Mathura Prasad Singh, M.L.C., Nawadah Sub-Division, District Gaya, Bihar
18 Shri K.V. Ramakrishna Reddy, Tanakallu Post, Kadiri Taluk, Anantapur District, Andhra Pradesh
19 Shri T. Sanganna, Rayaghada, P.O. Rayaghada, District Koraput, Orissa
20 Shri Rama Bahadur Sinha, P. O. Chhotapatti, District Darbhanga, Bihar
21 Shri K. Ramiah, Swathi 552, XIX Cross Road, Bangalore (Member Secretary).

APPENDIX XV

**Publications Committee**

*Members by Designation*

1 The Vice-President, Indian Council of Agricultural Research, New Delhi

2 The Agricultural Commissioner with the Government of India, New Delhi

3 The Animal Husbandry Commissioner with the Government of India, New Delhi

4 The Agricultural Extension Commissioner with the Government of India, Directorate of Extension & Training, New Delhi

5 The Agricultural Marketing Adviser to the Government of India, Directorate of Marketing & Inspection, Nagpur

6 The Plant Protection Adviser to the Government of India, Directorate of P. P. Q. & S., Ministry of Food & Agriculture, New Delhi

7 A Representative of the Community Projects Administration, Planning Commission, New Delhi

8 The Director, Indian Agricultural Research Institute, New Delhi

9 The Director, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh

10 The Director, National Dairy Research Institute, New Delhi

11 The Director of Agriculture, U.P., Lucknow

12 The Director of Animal Husbandry, Madras

13 The Director, Punjab Education Department, Chandigarh

14 The Director of Publicity, Ministry of Food & Agriculture, Government of India, New Delhi

15 The Secretary, Indian Council of Agricultural Research, New Delhi

16 The Editor, Indian Council of Agricultural Research, New Delhi

17 Editor (M) I.C.A.R.

18 Editor (B) I.C.A.R.

19 Deputy Director of Information, Extension and Training, Directorate of Extension and Training, Ministry of Food & Agriculture, New Delhi

*Members by Name*

1 Dr. S. Dutta, Old Baliganj, Second lane, Calcutta

2 Shri M.P. Gandhi, M.P. Gandhi & Co, Jan Mansions, Sir Pherozshah Mehta Road Fort, Bombay.

## APPENDIX XVI

ANNUAL ACCOUNTS FOR THE YEAR 1957-58

*I.C.A.R. (Research Side)*

RECEIPTS

| Head of Accounts | Receipts during the year | Total receipts |
|---|---|---|
| 1 | 2 | 3 |
| OPENING BALANCE— | | |
| (*i*) Cash Balance .. .. .. .. | 2,158·44 | |
| (*ii*) Bank Balance .. .. .. .. | 22,65,665·83 | |
| (*iii*) Provident Fund .. .. .. .. | 1,03,493·19 | |
| | 23,71,317·46 | 23,71,317·46 |
| I—RECEIPTS UNDER THE AGRICULTURE PRODUCE CESS ACT .. .. .. .. .. | | 39,79,234·46 |
| II—CONTRIBUTIONS and GRANTS— | | |
| (*a*) *From Constituent States*— | | |
| (*i*) Orissa .. .. .. .. | 60,000·00 | |
| (*ii*) Hyderabad (ICOC) .. .. .. | 2,45,750·00 | |
| Total .. | 3,05,750·00 | 3,05,750·00 |
| (*b*) *From Central Govt. for*— | | 7,54,528·61 |
| (*i*) Publication of Monograph on Rice in India .. | 13,338·61 | |
| (*ii*) Display Advisory Service .. .. | 30,000·00 | |
| (*iii*) Scheme for Research-cum-Extension on Bee-Keeping Industry .. .. .. .. | 9,540·00 | |
| (*iv*) Scheme for the production of campaign materials and training of State personnel .. | 30,000·00 | |
| (*v*) Improvement of Land Records and Agri. Statistics during 1957-58 .. .. .. | 11,000·00 | |
| (*vi*) Rinderpest eradication scheme .. .. | 40,000·00 | |
| (*vii*) Sample survey for the estimation of area and yield of pepper .. .. .. | 33,750·00 | |
| (*viii*) Research on development of pepper and Cashewnut .. .. .. .. | 53,000·00 | |
| (*ix*) Study of milk yield Breeds and management practices of Bovines in Eastern Region of India | 85,000·00 | |
| (*x*) Co-ordinated Cattle Sterility .. .. | 25,900·00 | |
| (*xi*) Production of Agricultural Instructional films .. | 75,000·00<br>48,000·00 | |
| (*xii*) Scheme for agronomic manurial trials .. | 3,00,000·00 | |
| Total .. | 7,54,528·61 | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 |
|---|---|---|
| II—CONTRIBUTION AND GRANTS—*contd.* | | |
| (*c*) *From other Sources*— | | 1,15,000·00 |
| (*i*) Contribution for the scheme of potash requirement of cotton and other crops .. .. | 15,000·00 | |
| (*ii*) The Controller of Accounts, Sindri Fertilisers and Chemicals Ltd. Sindri .. .. | 1,00,000·00 | |
| | 1,15,000·00 | |
| III—INTEREST ON INVESTMENTS— | | 5,98,525·07 |
| (*i*) 2¾% Loan 1962 .. .. .. .. | 26,059·59 | |
| (*ii*) 3% Loan 1963-65 .. .. .. | 49,361·27 | |
| (*iii*) 3% 2nd Victory Loan .. .. .. | 14,962·50 | |
| (*iv*) 3% Victory Loan 1957 .. .. .. | 23,144·49 | |
| (*v*) 3% Loan 1970-75 .. .. .. .. | 1,88,808·78 | |
| (*vi*) 3½% Govt. N.P.B. 1961 .. .. .. | 35,310·50 | |
| (*vii*) 3¾% Loan 1974 .. .. .. | 1,33,245·00 | |
| (*viii*) Fixed deposits etc. .. .. .. | .. | |
| (*ix*) Interest from short-term deposit receipts .. | 1,01,646·14 | |
| (*x*) 4% Loan 1972 .. .. .. .. | 25,986·80 | |
| Total .. | 5,98,525·07 | |
| IV—MISCELLANEOUS RECEIPTS— | | 7,71,793·87 |
| (*i*) Receipts realised from schemes .. .. | 71,242·86 | |
| (*ii*) Receipts on account of unspent balances of grants made by the Council .. .. | 1,50,581·09 | |
| (*iii*) Miscellaneous .. .. .. .. | 5,49,969·92 | |
| Total .. | 7,71,793·87 | |
| V—DEBTS AND REMITTANCES—*contd.* | | 2,776·24 |
| (*i*) *Loans and Advances*— | | |
| (*a*) Refund of cycle advances .. .. | 165·24 | |
| (*b*) Refund of motor cycle advances .. | 2,611·00 | |
| | 2,776·24 | |
| Miscellaneous | 9,49,969·92 (includes Rs. 7 lacs as grant made by the Government for supply of publications to N.E.S. Blocks. | |
| (—)Refund out of the grant made by the Government of India for supply of publications to N.E.S. Blocks. | (—)4,00,000·00 | |
| | 5,49,969·92 | |

APPENDIX XVI—*contd.*

| 1 | | 2 | 3 |
|---|---|---|---|
| V—Debts and Remittances—*contd.* | | | |
| (*i*) *Deposits and Advances repayable*— | | | 68,483·07 |
| (*a*) Subscription .. .. .. .. | | 59,235·63 | |
| (*b*) Repayment of advances from subscription .. | | 4,649·00 | |
| (*c*) Interest on advances .. .. .. | | 66·44 | |
| (*d*) Council's contribution .. .. .. | | 1,854·00 | |
| (*e*) Lapse and Forefeiture .. .. .. | | .. | |
| (*f*) Interest from investments .. .. | | 1,750·00 | |
| (*g*) Suspense .. .. .. .. | | 928·00 | |
| (*h*) Miscellaneous .. .. .. .. | | .. | |
| | Total .. | 68,483·07 | |
| (*iii*) *Other Deposits and Advances repayable*— | | | 8,420·00 |
| (*a*) Library Deposits .. .. .. | | .. | |
| (*b*) Permanent advance .. .. .. | | .. | |
| (*c*) Caution money deposit .. .. .. | | .. | |
| (*d*) Suspense .. .. .. .. | | .. | |
| (*e*) Other Deposits and Advances .. .. | | 8,420.00 | |
| | Total .. | 8,420·00 | |
| (*iv*) *Recoveries from Research Staff on account of Income Tax Prov., Fd. etc.*— | | | 55,600·94 |
| (*a*) Income Tax .. .. .. .. | | 9,168·02 | |
| (*b*) G. P. Fund .. .. .. .. | | 10,273·85 | |
| (*c*) Misc. recoveries .. .. .. .. | | 35,372·07 | |
| (*d*) Contributory Provident Fund .. .. | | 787·00 | |
| (*e*) Postal Life Insurance .. .. .. | | .. | |
| | Total .. | 55,600·94 | |
| **Total Receipts and Opening Balance .. ..** | | | **90,31,429·72** |
| **Investments and Re-investments .. .. ..** | | | **79,06,200·00** |
| | | | **1,69,37,629·72** |

APPENDIX XVI—*contd.*

PAYMENTS

| Grants | | | Head of the Account | Expenditure during the year | Excess (—) or Savings (+) over net grant | | Remarks |
|---|---|---|---|---|---|---|---|
| Original | Net | | | | | | |
| 1 | 2 | | 3 | 4 | 5 | | 6 |
| | | | A—*Standing Charges* | | | | |
| 1,15,000 | 1,06,700 | 1 | Accounts and Audit .. | 1,07,042·78 | (—) 342·78 | (a) | Inconsiderable. |
| 10,000 | 8,400 | 2 | Travelling allowance of non-official members of the Council | 8,330·33 | (+) 69·67 | (a) | |
| 25,000 | 40,900 | 3 | Travelling allowance of members of the committee of the Advisory Board and of other persons invited to attend the meetings | 39,995·76 | (+) 904·24 | (a) | |
| 2,000 | 3,400 | 4 | T. A. of non-official members of the Board of Agri. & A.H. | 3,321·94 | (+) 78·06 | (a) | |
| 1,230 | 9,500 | 5 | Misc. grant of V.P. .. | 9,447·03 | (+) 52·97 | (a) | |
| 1,40,000 | 19,500 | 6 | Editorial staff for Indian Farming & Kheti | 19,458·02 | (+) 41·98 | (a) | |
| 25,000 | 7,800 | 7 | Subsidies to various journals | 7,955·00 | (—) 155·00 | (a) | |
| 1,33,370 | 1,74,500 | 8 | Integrated Stat. Scheme | 1,74,452·71 | (—) 47·29 | (a) | |
| 750 | 400 | 9 | Publication of Abstracts for Indian Journal of Veterinary Science | 340·00 | (+) 60·00 | (a) | |
| 1,53,320 | 1,08,00 | 10 | Publicity Scheme .. | 1,06,924·45 | (+) 1,075·45 | (a) | |
| 12,000 | 2,100 | 11 | Publication of a quarterly Rice News Teller | 2,044·20 | (+) 55·80 | (a) | |
| 72,950 | 26,600 | 12 | Publication of Dharti-ke-lal. | 27,168·70 | (—) 568·70 | (a) | |
| 6,400 | .. | 13 | Printing of technical bulletin in scientific review series | .. | .. | | |
| 4,000 | .. | 14 | Publication of research news letter | .. | .. | | |
| 60,000 | 21,400 | 15 | Setting up of a Central Film Library | 21,327·64 | (+) 72·36 | (a) | |
| 85,700 | 38,100 | 16 | Press Section .. | 39,542·12 | (—) 1,442·12 | (a) | |
| 50,000 | 40,400 | 17 | Printing of Research and review series of publications issued by the Council | 40,341·11 | (+) 58·89 | (a) | |
| 70,000 | 23,600 | 18 | Printing of handbook series of the Council | 28,541·47 | (—) 5,058·53 | (a) | |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | *A—Standing Charges*—contd. | | | |
| 2,00,000 | 1,05,200 | 19 | Establishment of a Central Distribution section for the publications of the Council. | 1,05,028·49 | (—) 171·51 | (*a*) |
| 20,000 | 3,500 | 20 | Farm news and Press releases. | 8,403·04 | (—) 4,903·04 | (*a*) |
| 41,300 | 42,700 | 21 | Library .. | 43,208·78 | (—) 508·78 | (*a*) |
| 10,800 | .. | 22 | Compilation of agriculture and A.H. in India. | .. | .. | |
| 12,000 | 9,600 | 23 | Abstraction of Horti. Literature. | 9,532·46 | (+) 67·54 | (*a*) |
| .. | 1,600 | 24 | Research workers Conference. | 4,463·95 | (—) 2,863·95 | (Due to amalgamation of Hortl. Res. workers conference for which no provision was made in the Budget.) |
| | | | *B—Research training and publicity under direct control of I.C.A.R.* | | | |
| | | | (i) *Agriculture* | | | |
| .. | 10,000 | 1 | Indian Institute of Fruit Technology. | 10,000·00 | .. | Representing refund to Government of India. |
| .. | .. | 2 | Indian Institute of Fruit Technology (Devd.) | 976·42 | (—) 976·42 | (*a*) Do. |
| .. | 300 | 3 | Experiments on Katka phosphate and dicalcium phosphate. | 277·12 | (+) 22·88 | (*a*) |
| 65,000 | 24,000 | 4 | Co-ordinated grass land Survey. | 34,050·66 | (—) 10,050·66 | Excess due to total ling mistake at the time of re-appropriation. |
| 1,40,000 | 19,800 | 5 | Co-ordinated Millets Scheme I.C.A.R. | 21,368·05 | (—) 1,568·05 | (*a*) |
| 3,020 | 6,100 | 6 | Monograph on poisonous plant. | 6,019·00 | (+) 81·00 | (*a*) |
| .. | 18,000 | 7 | Manufacture of wine | 17,913·23 | (+) 86·77 | (*a*) represents refund to G/I. |
| 25,400 | 17 | 8 | Description of different varieties of fruits. | 16,776·13 | (+) 223·87 | (*a*) |
| .. | 8,100 | 9 | Co-ordinated wheat rust control scheme. | 80,410·21 | (—) 72,310·21 | Refund of Rs. 75,000 to G/I. The figures of expenditure of Rs. 75,000 refunded to the Govt. of India was not accounted at the time of re-appropriation. |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | B—*Research training and publicity under direct control of I.C.A.R.*—contd. | | | |
| | | | (i)—*Agriculture*—contd. | | | |
| 9,850 | 20,700 | 10 | Manurial trials and agronomic experiments. | 22,256·91 | (—) 1,556·91 | A debit for Rs. 1,583 was raised after re-appropriation. |
| 16,600 | 600 | 11 | Proposal for obtaining Italian expert on Horticulture. | 542·11 | (+) 57·89 (*a*) | |
| 17,300 | 1,300 | 12 | Spices and Cashewnut Show. | 1,250·56 | (+) 49·44 (*a*) | |
| — | 40,200 | 13 | Scheme for preparing Agriculture Handbook for India. | 40,789·41 | (—) 589·41 (*a*) | |
| 4,000 | .. | 14 | Foreign expert for the Co-ordination of Plant Harmones scheme. | .. | .. | |
| 78,300 | 29,300 | 15 | All India Fruit Show. | 29,118·60 | (+) 181·40 (*a*) | |
| | 7,000 | 16 | Survey of fertiliser practices. | 6,923·99 | (+) 76·01 (*a*) | |
| 38,300 | 34,500 | 17 | Co-ordination of Research. | 34,438·62 | (+) 61·38 (*a*) | |
| 91,300 | 7,900 | 18 | Survey of Agricultural practices. | 7,876·45 | (+) 23·55 (*a*) | |
| — | .. | 19 | Wheat Research Workers Conference. | 37·37 | (—) 37·37 (*a*) | |
| — | 34,960 | 20 | Composting of manure co-ordinated. | 35,012·41 | (—) 52·41 (*a*) | |
| — | 3,66,870 | 21 | Crop cutting experiments on wheat and paddy. | 3,60,899·58 | (—) 29·58 (*a*) | |
| | | | (*ii*) *Animal Husbandry* | | | |
| 2,000 | — | 1 | Monograph on Helminth Parasites of domesticated animals in India. | .. | .. | |
| 20,000 | 32,300 | 2 | Appointment of a Liaison Officer for sheep and wool schemes. | 32,237·04 | (+) 62·96 (*a*) | |
| 15,120 | 4,900 | 3 | Assignment of sheep and wool expert of F.A.O. | 4,859·48 | (+) 40·52 (*a*) | |
| 11,230 | .. | 4 | Consideration of the recommendation of the committee of Indigeneous drugs. | .. | .. | |
| 2,000 | .. | 5 | Manual on preparation of animals for Indian Market. | .. | .. | |
| 19,260 | 12,700 | 6 | Co-ordination of Research on A.H. Creation of a Co-ordinated Unit. | 12,627·96 | (+) 72·04 (*a*) | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | B—*Research training and publicity under direct control of I.C.A.R.*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| 31,400 | .. 7 | Compilation & publication of Indian Dairy year Book. | 11,343·64 | (—) 11,343·64 | (*a*) |
| 1,000 | .. 8 | Manual on Breeding of farm animals in India. | .. | .. | |
| .. | 100 9 | Monographon Chemotherapy and animal Trypanosomiasis. | 17·53 | (+)82·47 | (*a*) |
| .. | 8,900 10 | Cattle sterility .. | 8,818·05 | (+)81·95 | (*a*) |
| 42,600 | 19,700 11 | Expansion of Central Herd Book Scheme. | 19,612·51 | (+)87·49 | (*a*) |
| 1,24,000 | 8,600 12 | Central Dairy Information Bureau. | 8,513·93 | (+)86·07 | (*a*) |
| 1,00,000 | 10 13 | Potentialities of Indian village cattle for increased milk production through better feeding and management. | 7·75 | (+)2·25 | (*a*) |
| 20,270 | .. 14 | Definition of ideal animal I.C.A.R. | .. | .. | |
| 5,770 | .. 15 | Monograph on Statistical method, in A.H. | .. | .. | |
| .. | 200 16 | Survey of cattle breeding, I.C.A.R. | 129·33 | (+)70·67 | (*a*) |
| | | (*iii*) *Miscellaneous* | | | |
| 65,360 | 23,900 1 | Integrated publicity works. | 28,031·62 | (—)4,131·62 | (*a*) |
| 81,360 | 52,300 2 | National Index of Field experiments. | 52,098·82 | (+)201·18 | (*a*) |
| 11,600 | 11,800 3 | Award of fellowships to the diploma course students in Agriculture statistics | 11,723·31 | (+)76·69 | (*a*) |
| 4,200 | .. 4 | Assignment of Dr. F. Yates, F.A.O. | .. | .. | |
| .. | 100 5 | Training Centre for experimental designs in Agri. & A. H. | 77·99 | (+)22·01 | (*a*) |
| .. | 6,000 6 | Publication of Dhartike-lal (Ford Foundation). | 5,994·81 | (+)5·19 | (*a*) |
| .. | 97,800 7 | Study of milk yield breeds and management practices of Bovines. | 97,773·09 | (+)26·91 | (*a*) |
| .. | 10,500 8 | Training Centre of Land Records. | 10,481·76 | (—)18·24 | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | B—*Research training and publicity under direct control of I.C.A.R.*—contd. | | | |
| | | | (*iii*) *Miscellaneous*—contd. | | | |
| .. | 4,000 | 9 | Pilot samples survey pepper. | 3,976·77 | (+)23·23 (*a*) | |
| .. | 600 | 10 | Agricultural Exhibition at Ceylon and Amritsar. | 593·80 | (+)6·20 (*a*) | |
| 3,00,000 | 6,800 | 11 | Setting up of Central Co-ordinated film production Unit | 5,758·32 | (+)1,041·88 (*a*) | |
| .. | 40,100 | 12 | Display Advisory Service. | 40,280·60 | (—)180·60 (a) | |
| .. | 77,000 | 13 | Cost of milk Production in India. | 76,560·38 | (+)439·62 (*a*) | |
| .. | 1,700 | 14 | Production of campaign material and training of state personnels. | 1,669·49 | (+)30·51 (*a*) | |
| 3,50,530 | 11,06,200 | 15 | Building of the I.C.A.R. | 11,07,184·06 | (—)984·06 (*a*) | |
| 20,000 | 27,600 | 16 | Indian Council of Agri. Veterinary education. | 27,550·71 | (+)49·29 (*a*) | |
| .. | 8,000 | 17 | Preparation of propaganda material for Rinderpest Eradication. | 7,926·83 | (+)73·17 (*a*) | |
| .. | 500 | 18 | Appointment of Shri J. Malcalm Orchard under Point Four Programme. | 480·23 | (+)19·77 (*a*) | |
| .. | 3,300 | 19 | International Farm Youth Exchange. | 3,268·23 | (+)31·77 (*a*) | |
| 12,000 | 15,800 | 20 | Publication of a book on flowering trees in India. | 22,971·42 | (—) 7,171·42 | Excess due to error in totalling at the time of re-appropriation. |
| 15,000 | .. | 21 | Publication of a hand book on Horticulture. | .. | .. | |
| 67,900 | 11,500 | 22 | Publication of Crop Calendars and Charts. | 11,417·80 | (+)82·20 (*a*) | |
| 10,59,000 | 6,58,000 | 23 | Supply of Agriculture Information literature to N.E.S. Blocks. | 6,57,954·45(*) | (+)45·54 (*a*) | (*) Actual amount debt. during 1957-58 Rs. 6,60,207·09. *less* excess amount —2,252·63. Actual amount Rs. 6,57,954·46. |
| 1,65,320 | 18,700 | 24 | Bringing out publications of the Council in regional languages. | 19,009·24 | (—) 309·24 (*a*) | |
| 81,300 | 60,400 | 25 | Setting up an Exhibition Unit. | 60,312·69 | (+)87·31 (*a*) | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | B—*Research training and publicity under direct control of I.C.A.R.*—contd. | | | |
| | | (*iii*) *Miscellaneous*—contd. | | | |
| 10,000 | .. | 26 Crop cutting experiments on oil seed, U. P. and Madras I.C.A.R. | .. | .. | .. |
| .. | 11,300 | 27 Crop cutting experiments on Jute. | 11,271·34 (+) | 28·66 | (*a*) include refund of Rs. 11,269·34 to G/I. |
| 5,000 | 3,800 | 28 Duplicating Section | 3,739·78 (+) | 60·22 (*a*) | |
| .. | 100 | 29 Japanese Method of Paddy cultivation. | 100·00 | .. | |
| .. | .. | 30 Village Project, Delhi | 1,655·50 (—) | 1,656·50 (*a*) | |
| 1,020 | .. | 31 Research fellowship in Agriculture. | 805·36 (—) | 805·36 (*a*) | |
| .. | 3,500 | 32 Survey of Indigenous Implements. | 3,419·68 (+) | 80·32 (*a*) | |
| 10,000 | 100 | 33 Award of prizes for improvement in Agriculture. | 36·00 (+) | 64·00 (*a*) | |
| 45,000 | .. | 34 Award of prizes for outstanding Research work done in the field of Agriculture & A. H. and allied sciences. | .. | .. | |
| 5,200 | .. | 35 Proposal to invite eminent Statisticians under Colombo Plan. | .. | .. | |
| .. | 17,100 | 36 Fuel gas from cattle dung. | 17,024·92(+) | 65·68 | (*a*) represents refund to G/I. |
| 6,000 | .. | 37 Publication of Dhartike-lal in regional languages. | .. | .. | |
| 10,000 | .. | 38 Printing of small digests of important publications of the Council. | .. | .. | |
| .. | 800 | 39 Printing of the monograph on veterinary entomology and Acarology for India. | 774·35 (+) | 25·65 (*a*) | |
| .. | 6,600 | 40 A hand book on Indian Agriculture. | 6,558·75 (+) | 41·25 (*a*) | |
| 7,510 | 100 | 41 Printing of a hand book of statistics for the use of Agricultural Research Workers. | 52·99 (+) | 47·01 (*a*) | |
| 1,17,220 | 35,900 | 42 Building of the Statistical Wing I.C.A.R. | 35,891·46 (+) | 8·43 (*a*) | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | B—*Research training and publicity under direct control of I.C.A.R.*—contd. | | | |
| | | (*iii*) *Miscellaneous*—contd. | | | |
| 4,670 | .. 43 | Fellowships in Statistics. | .. | .. | (*a*) |
| 1,53,360 | 27,500 44 | Printing of Kheti .. | 32,449·55 (—) | 4,949·55 | (*a*) |
| 80,000 | .. 45 | Estimation of cost of production of cotton and other rotation crops. | .. | — | |
| 50,000 | .. 46 | Enquiry into factors influencing crop Patterns on individual farms. | — | — | |
| 23,370 | .. 47 | Further investigation on the technique of sampling of fleeces for assessing wool quality. | .. | .. | |
| .. | 15,100 48 | Sugar cane production | —15,004·66 (—) | 95·34 | (*a*) includes refund of Rs. 15,000 to G/I. |
| .. | 5,400 49 | Preparation of reviews on research work done in the field of Agriculture & A.H. | 5,306·61 (+) | 93·39 | (*a*) |
| 27,400 | 27,400 50 | Publication of a quarterly popular Journal on Indian Horticulture. | 27,352·22 (+) | 47·78 | (*a*) |
| 38,000 | 100 51 | Publication of a Monograph 'Mango'. | 50,005·87 (—) | 49,905·87 | The figures of expenditure of Rs. 50,000 was not included at the time of re-appropriation. |
| 20,000 | 600 52 | Publication of Monographs. | 600·00 | .. | |
| 40,000 | .. 53 | Publication of a monograph entitled 'Poultry'. | .. | .. | |
| 86,000 | .. 54 | Preparation of monograph on the different groups of Fungi and the diseases of various crops. | .. | .. | |
| 62,900 | 5,500 55 | Preparation of a monograph on Algae. | 5,462·09 (+) | 37·91 | (*a*) |
| 13,000 | .. 56 | Preparation of monograph Agriculture Meteorology. | .. | .. | |
| 15,900 | .. 57 | Revision on monograph on Potatoes. | .. | .. | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | B—*Research training and publicity under direct control of I.C.A.R.*—concld. | | | |
| | | (*iii*) *Miscellaneous*—concld. | | | |
| 24,000 | .. 58 | Reprinting of the hand book on statistical methods for the Agricultural Research works by Dr. Panse and Sukhatme. | .. | .. | |
| 3,000 | 10 59 | Translation into Spanish of the book on Statistical methods for Agriculture Workers by Dr. Panse and Sukhatme. | 2·00 (+) | 8·00 (*a*) | |
| 2,150 | 12 60 | Free supply of I.C.A.R. publications to the various Agricultural and Veterinary colleges in India. | .. | .. | |
| 7,750 | .. 61 | Publication of quarterly journal on Agricultural Education. | .. | .. | |
| .. | 6,800 62 | Printing of Text Books for Village level Workers. | 6,786·24 (+) | 13·76 (*a*) | |
| .. | 400 63 | Scheme for reconciliation of difference in Tobacco areas. | 379·94 (+) | 20·06 (*a*) | |
| .. | 1,500 64 | Ad-hoc Rice Committee. | 1,438·88 (+) | 61·12 (*a*) | |
| .. | 200 65 | Printing of a comprehensive publication of Agriculture Research in India. | 105 (+) | 94·88 (*a*) | |
| .. | 200 66 | Preparation of a monograph on different cereal crops. | 176·19 (+) | 23·81 (*a*) | |
| 35,000 | 5,600 67 | Setting up of a Central Stores Organisation. | 5,510·82 (+) | 80·18 (*a*) | |
| | | Headquarter—Grant-in-aid Schemes | | | |
| | | C—*Grant-in-aid.* | | | |
| | | (*i*) *Agriculture* | | | |
| | | (a) Rice | | | |
| 5,400 | 8,000 1. | Improvement of Paddy M.B. (M.P. | 7,907·00 (+) | 93·00 (*a*) | |
| 12,600 | 10,400 2 | Rice Breeding Pb. Coorg | 10,336·41 (+) | 63·59 (*a*) | |
| 8,500 | 7,000 3 | Rice Breeding Pb. Mysore. | 7,000·00 | .. | .. |
| | 17,200 4 | Seed Multiplication, Orissa. | 17,186·00 | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants in-aid*—contd. | | | |
| | | | (i) *Agriculture*—contd. | | | |
| | | | (a) Rice—*contd.* | | | |
| 16,860 | 16,000 | 5 | Survey and collection of paddy C.R.R.I. | 16,000·00 | .. | .. |
| 25,820 | 6,400 | 6 | Blast and foot rot diseases of Rice and wheat, Bombay. | 6,309·00 (+) | 91·00 (*a*) | |
| 6,500 | 6,400 | 7 | Rice Stem borer Madras. | 6,387·00 (+) | 13·00 (*a*) | |
| 7,200 | 6,500 | 8 | Rice Stem borer Hyderabad (Andhra). | 6,500·00 | .. (*a*) | |
| 10,400 | 8,400 | 9 | Rice Stem Borer West Bengal. | 8,310·14 (+) | 89·86 (*a*) | |
| 7,300 | 7,400 | 10 | Rice Stem borer Andhra. | 7,351·00 (+) | 49·00 (*a*) | |
| 4,200 | 4,100 | 11 | Stem rot disease of Rice Madras. | 4,100·00 | .. | .. |
| 8,130 | .. | 12 | Rice Physiology Cal. University. | .. | .. | .. |
| 11,800 | .. | 13 | Boro Paddy W. Bengal | .. | .. | .. |
| 5,600 | 200 | 14 | Breeding salt and flood resistant varieties Assam. | 169·00 (+) | 31·00 (*a*) | |
| 8,700 | 7,000 | 15 | Breeding salt and flood resistant varieties, Kerala. | 6907·98 (+) | 92·02 (*a*) | |
| 18,700 | 13,300 | 16 | Breding salt and flood resistant varieties, W. Bengal. | 13,243·80 (+) | 56·20 (*a*) | |
| 8,080 | 9,100 | 17 | Scheme for work on Rice in saline areas, Andhra. | 9,088·00 (+) | 12·00 (*a*) | |
| 8,540 | .. | 18 | Cultural studies with Upland paddy West Bengal. | .. | .. | .. |
| 6,880 | .. | 19 | Blast resistance of paddy Coimbatore, Madras. | .. | .. | .. |
| 3,170 | .. | 20 | Investigation on Boro Paddy, U.P. | .. | .. | .. |
| 4,990 | 3,700 | 21 | Deep Water paddy, U. P. | 3,650·00 (+) | 50·00 (*a*) | |
| 4,320 | 4,800 | 22 | Hill paddy, U. P. .. | 4,720·00 (+) | 80·00 (*a*) | |
| 8,300 | 2,000 | 23 | Draught resistant strains of Paddy, Kerala. | 1,970·00 (+) | 30·00 (*a*) | |
| 8,700 | 12,800 | 24 | Deep water paddy, Andhra. | 12,776·00 (+) | 24·00 (*a*) | |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants-in-aid*—contd. | | | |
| | | | (*i*) *Agriculture*—contd. | | | |
| | | | (a) Rice—*contd.* | | | |
| 14,000 | 6,500 | 25 | Rice improvement Scheme Kashmir. | 6,500·00 | .. | (*a*) |
| 5,600 | .. | 26 | Physiology of Rice Flowering W. Bengal. | .. | .. | .. |
| 6,900 | 6,100 | 27 | Breeding varieties resistant to piricularia Madras. | 6,071·00 | (+) 29·00 | (*a*) |
| 8,480 | 7,000 | 28 | Breeding varieties resistant to piricularia Andhra. | 7,000·00 | .. | .. |
| 2,020 | 1,700 | 29 | Study on paddy Agromyzed Hyderabad (Andhra). | 1,650·00 | +) 50·00 | (*a*) |
| 2,250 | .. | 30 | Manurial experiments on Paddy lands W. Bengal. | .. | .. | .. |
| .. | 7,000 | 31 | Improvement of hill paddy Assam. | 7,000·00 | .. | .. |
| 9,160 | .. | 32 | Breeding non-lodging non shedding and flood resistant paddy, M.P. | .. | .. | .. |
| 8,200 | 8,000 | 33 | Breeding Paddy for lift irrigation areas Andhra. | 7,950·00 | (+) 50·00 | (*a*) |
| 3,000 | 1,300 | 34 | Tabi Nurseries of Paddy Andhra. | 1,300·00 | .. | .. |
| 2,800 | .. | 35 | Bacterial Blight diseases of Paddy Bombay. | .. | .. | .. |
| 16,800 | 8,300 | 36 | Breeding strains Resistant to lodging of Rice C.R.R.I. | 8,291·88 | (+) 8·12 | (*a*) |
| 15,000 | .. | 37 | Induction and study of Amphipoidy in Rice W. Bengal. | .. | .. | .. |
| | | | (b) Wheat and other Cereals | | | |
| 14,350 | .. | 38 | Maize Breeding Punjab | .. | .. | .. |
| 9,800 | 800 | 39 | Maize Breeding U.P. | 774·00 | (+) 26·00 | (*a*) |
| 13,800 | 300 | 40 | Maize Breeding and Paddy W. Bengal. | 207·52 | (+) 92·48 | (*a*) |
| 3,430 | .. | 41 | Hybrid corn seed Vivekananda Laboratory, Almora. | .. | .. | .. |

APPENDIX XVI—*coctd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants-in-aid*—contd. | | | |
| | | | (*i*) *Agriculture*—contd. | | | |
| | | | (b) Wheat and other Cereals—*contd.* | | | |
| 15,510 | 20,700 | 42 | Improvement of Pastures and legumes I.A.R.I. | 20,620·27 | (+) 79·73 (*a*) | |
| 4,690 | .. | 43 | Nutritive value of Wheat I.A.R.I. | .. | .. | .. |
| 7,500 | 7,900 | 44 | Improvement of pastures and legumes M. P. (Bombay). | 7,805·00 | (+) 95·00 (*a*) | |
| 12,970 | 5,700 | 45 | Improvement of pastures and legumes Bombay. | .. | (+) 5,700·00 | Due to an over sight a sum of Rs.5,640 was debited to Improvement of pastures & legumes Bombay instead of the scheme. |
| 6,000 | 200 | 46 | Foot rot of wheat Bombay (M.P.) | 5 ,792·00 | (—) 5,592·00 | |
| 9,400 | 16,700 | 47 | Studies on wheat Bombay. | 17,214·00 | (—) 512·00 | |
| .. | 1,300 | 48 | Cereal rusts Agra .. | 1,293·94 | (+) 6·06 (*a*) | |
| .. | 1,500 | 49 | Co-ordinated wheat rust control M. P. | 1,454·00 | (+) 46·00 (*a*) | |
| 34,640 | 200 | 50 | Maize Breeding I.A.R.I. | 133·00 | (+) 67·00 (*a*) | |
| 14,000 | .. | 51 | Hybrid Maize Mysore | .. | .. | .. |
| 5,28,100 | 60,200 | 52 | Co-ordinated Maize Breeding Scheme I.A.R.I. | 60,190·00 | (+) 10·00 (*a*) | |
| | 32,200 | 53 | Co-ordinated Maize Breeding Scheme Bihar. | 6,440·00 | (+) 60·00 (*a*) | |
| | 32,200 | 54 | Co-ordinated Maize Breeding Scheme Punjab. | 25,700·00 | (+) 60·00 (*a*) | |
| | 34,300 | 55 | Co-ordinated Maize Breeding Scheme U.P. | 34,240·00 | (+) 60·00 (*a*) | |
| | 16,700 | 56 | Wheat and other Cereals Vivekananda Lab. Almora. | 27,906·00 | (—) 11,206·00 | |
| | 35,900 | 57 | Wheat and other Cereals Vivekananda Lab., Andhra. | 35,860·00 | (+) 40·00 (*a*) | |
| 3,110 | 200 | 58 | Maize Breeding Hyderabad. | 128·00 | (+) 72·00 (*a*) | |
| 4,210 | .. | 59 | Maize Breeding Rajasthan. | .. | .. | .. |
| 2,910 | .. | 60 | Maize Breeding Pepsu (Pb.) | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in aid*—contd. | | | |
| | | (*i*) *Agriculture*—contd. | | | |
| | | (b) Wheat and other Cereals—*concld.* | | | |
| 4,500 | .. | 61 Maize Breeding Kashmir. | .. | .. | .. |
| 6,500 | 5,000 | 62 Wheat Breeding Rajasthan. | 5,000·00 | .. | .. |
| 3,240 | .. | 63 Barley improvement Rajasthan. | .. | .. | .. |
| 9,200 | 200 | 64 Research on fodder Production W. Bengal | 144·78 (+) | 55·22 (*a*) | |
| 6,000 | .. | 65 Research on fodder Production Bihar. | .. | .. | .. |
| 4,900 | 4,200 | 66 Research on fodder Production Mysore. | 186·16 (+) | 13·84 (*a*) | |
| 4,000 | .. | 67 Research on fodder Production Coorg (Mysore.) | 4,000 (+) | .. | .. |
| 7,500 | .. | 68 Research on fodder Production Bhopal (M.P.) | .. | .. | .. |
| 6,000 | 5,000 | 69 Research on fodder Production Andhra. | 5,000 | .. | |
| 5,800 | 5,000 | 70 Research on fodder Production Madras. | 5,030 (—) | 30·00 (*a*) | |
| .. | .. | 71 Wheat Breeding I.A. R.I. | 1,236·41 (—) | 1,236·41 (*g*) This expenditure was not taken into account at the time of re-appropriation. | |
| 7,270 | 3,700 | 72 Cytogenetical studies on Maize, Andhra University. | 3,630·00 (+) | 70 (*a*) | |
| 21,880 | .. | 73 Cytogenitics of leguminous Crops, Presidency College, Calcutta. | .. | .. | .. |
| 5,630 | .. | 74 Cytogenetics of Wild grasses, Madras. | .. | .. | .. |
| 4,540 | .. | 75 Control of wilt of maize, Bihar. | 1700 (—) | 1,700 (*g*) | |
| 6,320 | .. | 76 Drought resistance of Wheat M. P. | .. | .. | .. |
| | | (c) Millets and Pulses | | | |
| 4,500 | 2,600 | 77 Pulse Breeding M. P. (Gwalior). | 2,566·16 (+) | 33·84 (*a*) | |
| 9,640 | 3,300 | 78 Hybrid Bajra, Bombay | 3,210·00 (—) | 90·00 (*a*) | |
| 7,800 | 7,000 | 79 Striga attack on Sorgham, Andhra. | 7,000·00 | .. | |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants-in aid*—contd. | | | |
| | | | (*i*) *Agriculture*—contd. | | | |
| | | | (c) Millets and pulses—*contd.* | | | |
| 14,480 | 12,000 | 80 | Hybrid Combu, Madras | 12,000·00 | .. | .. |
| 9,800 | 1,200 | 81 | Jowar and Bajra Breeding. | 1,196·00 (+) | 4·00 | .. |
| .. | 2,700 | 82 | Pulse Breeding Madras | 2,610·00 (+) | 90·00 | .. |
| 5,300 | 5,300 | 83 | Diseases of Bajra Anand Inst. | 5,300·00 (+) | | .. |
| 4,000 | 600 | 84 | Pulse Research, Assam | 540·04 (+) | 59·96 (*a*) | |
| 5,750 | .. | 85 | Improvement of pulses, Andhra. | .. | .. | .. |
| 5,900 | 5,500 | 86 | Pulse Breeding W. Bengal. | .. | .. | .. |
| 7,070 | 4,630 | 87 | Storage and viability of pollen grains, Delhi University. | 4,630·00 | .. | .. |
| | | | (d) Fruits | | | |
| 19,780 | .. | 88 | Horticulture Tharasa (Bombay). | 234·00 (—) | 234·00 (*a*) | |
| .. | 3,400 | 89 | Horticulture Tharasa Assam. | 3,374·50 (+) | 25·50 (*a*) | |
| 14,400 | 16,700 | 90 | Horticulture Tharasa Orissa. | 16,634·00 (+) | 66·00 (*a*) | |
| 11,040 | 12,000 | 91 | Horticulture Tharasa Hyderabad (Andhra). | 12,000·00 | .. | |
| 30,800 | 29,000 | 92 | Horticulture Tharasa H.P. | 29,000·00 | .. | |
| 23,730 | 14,800 | 93 | Orange cultivation Coorg (Mysore). | 14,773·00 (+) | 27·00 (*a*) | |
| 6,000 | 6,300 | 94 | Virus diseases and other disorders of stone hill fruits. D.S.B. College, Nainital U.P. | 6,300·00 | .. | |
| 27,780 | 13,000 | 95 | Banana Research Madras. | 13,003·00 (+) | 3·00 (*a*) | .. |
| 11,400 | 5,800 | 96 | Banana Research Bombay. | 5,748·00 (+) | 52·00 (*a*) | |
| 20,900 | 23,100 | 97 | Banana Research W. Bengal | 23,003·98 (+) | 96·02 (*a*) | |
| 8,300 | 3,000 | 98 | Banana Research Andhra. | 3,000·00 | | .. |
| 5,400 | 4,700 | 99 | Citrus Manurial trials, Punjab. | 4,620·00 (+) | 80·00 (*a*) | |
| 6,300 | .. | 100 | Remedial measures against Sanjose scale, Kashmir. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants-in-aid*—contd. | | | |
| | | | (*i*) *Agriculture*—contd. | | | |
| | | | (d) Fruits—*contd.* | | | |
| 410 | .. | 101 | Chemical composition and Nutritive value of Fruit and Vegetable, Coonoor. | .. | .. | .. |
| 1,24,000 | .. | 102 | Establishment of Horticultural Plant Introduction Station at Saharanpur U.P. and Hassarghatha(Mysore) I.A.R.I. | .. | .. | .. |
| 2,340 | .. | 103 | Cytogenetical studies on grapes and related wild spices Madras. | .. | .. | .. |
| 4,180 | 2,500 | 104 | Investigation of root, rot limb breakage Andhra. | 2,500·00 | .. | .. |
| 4,450 | .. | 105 | Twig-blight diseases of orange, W. Bengal. | .. | .. | .. |
| 7,220 | .. | 106 | Research on pine-apples. | .. | .. | .. |
| .. | 2,310 | 107 | Citrus root stock trials at Kodur Madras. | 2,306·00 | (+) 4·00 | (*a*) |
| 7,470 | 13,000 | 108 | Citrus root stock trials at Kodur Andhra. | 12,905·00 | (+) 95·00 | (*a*) |
| 65,000 | 31,000 | 109 | Co-ordinated study for the application of growth regulating substances in horticulture Pb. | 31,000·00 | .. | .. |
| 36,000 | 44,000 | 110 | Co-ordinated study for the application of growth regulating substances in horticulture Andhra. | 44,000·00 | .. | .. |
| 7,700 | 5,000 | 111 | Co-ordinated study for the application of growth regulating substances in horticulture I.C.C.C. | 5,000·00 | .. | .. |
| 6,500 | 5,000 | 112 | Cytogenetical Investigation on fruit trees, Cal. University. | 5,000·00 | .. | .. |
| 4,150 | .. | 113 | Wilt disease of guara W. Bengal. | .. | .. | .. |
| 9,200 | .. | 114 | Research in fruits Kashmir | .. | .. | .. |
| 28,400 | .. | 115 | Investigation in die-back diseases of citrus I.A.R.I. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (d) Fruits—*contd.* | | | |
| 1,06,930 | 63,200 | 116 Investigation in die-back diseases of citrus, Coorg (Mysore). | 63,200·00 | .. | .. |
| 31,000 | 25,900 | 117 Investigation in die-back diseases of citrus, Bombay. | 25,900·00 | .. | .. |
| 23,200 | .. | 118 Date Palm, Punjab | .. | .. | .. |
| 18,000 | 13,300 | 119 Establishment of Fruit Research stations in Plains U.P. | 13,398·00 | (—) 98·00 | (*a*) |
| 9,640 | .. | 120 Increase in yield of fruits and vegetables by Bee-polination Bombay. | .. | .. | .. |
| 2,000 | 700 | 121 Training in fruit and Vegetable preservation Andhra. | 700·00 | .. | .. |
| 43,630 | 8,000 | 122 Co-ordinated scheme on the effect of chemicals on the storage of Fruits and Vegetables C.F.T.R.I. | 8,000·00 | .. | .. |
| .. | .. | 123 Co-ordinated scheme on the effect of chemicals on the storage of Fruits and Vegetables C.F.T.R.I. Assam. | 727·00 | (—) 727·00 | This item of expenditure not taken into a/c at the time of re-appropriation |
| 4,800 | 5,300 | 124 Research on Cashew-nuts Andhra. | 5,299·00 | (+) 1·00 | (*a*) |
| 5,860 | 4,900 | 125 Research on Cashew-nuts Bombay. | 4,813·00 | (+) 87·00 | (*a*) |
| 7,370 | 9,500 | 126 Bunchy top disease of Bananas Travancore Cochin (Kerala), | 9,500·00 | .. | .. |
| .. | 1,700 | 127 Co-ordinated scheme on the effect of chemicals on the storage of fruits and vegetables M. P. Bombay. | 1,692·00 | (+) 8·00 | (*a*) |
| .. | 200 | 128 Co-ordinated scheme on the effect of chemicals on the storage of fruits and vegetables, Bombay. | 116·00 | (+) 84·00 | (*a*) |
| .. | 2,400 | 129 Co-ordinated scheme on the effect of chemicals on the storage of fruits and vegetables, Punjab. | 2,400·00 | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*i*) *Agriculture*—contd. | | | |
| | | (d) Fruits—*contd.* | | | |
| 3,000 | .. | 130 Improvement of Ber fruit, Saurashtra, Bombay. | .. | .. | .. |
| 3,200 | .. | 131 Improvement of Ber fruit, V.P. (M.P.). | .. | .. | .. |
| 3,200 | .. | 132 Improvement of Ber fruit, Pepsu (Pb.). | 2,200·00 | (—) 2,200·00 | A sum of Rs. 2,200 was debited wrongly to the scheme under item No. 151. of C. A. instead of improvement of Ber Fruit Pepsu (Pb.). |
| 3,000 | .. | 133 Improvement of Ber fruit, Ajmer (Rajashthan). | .. | .. | .. |
| 3,000 | 1,700 | 134 Improvement of Ber fruit, M. P. | 1,613·00 | (+) 87·00 | (*a*) |
| 13,300 | 20,900 | 135 Improvement of Ber Fruit trees Pepsu (Pb.) | 20,700 | (+) 200·00 | (*a*) |
| 2,000 | .. | 136 Training in Fruit and Vegetable preservation, M.P. | .. | .. | .. |
| 2,000 | .. | 137 Training in Fruit and Vegetable preservation, W. Bengal. | .. | .. | .. |
| 15,570 | 11,500 | 138 Improvement of pine-apple by application of growth regulating substances (Gauhati University) Assam. | 11,500·00 | .. | .. |
| 2,000 | 2,000 | 139 Fruit preservation Hyderabad (Andhra). | 2,000·00 | .. | .. |
| 8,600 | 4,000 | 140 Research on pests of vegetables and fruit trees (Pb.) | 4,000·00 | .. | .. |
| 6,400 | .. | 141 Research on pests of citrus, Hyderabad (Andhra). | .. | .. | .. |
| 7,730 | 3,400 | 142 Investigation of fruit pests Andhra. | 3,400·00 | .. | .. |
| 5,170 | 4,800 | 143 Chlorosis of Banana Bombay. | 4,720·00 | (+) 80·00 | (*a*) |
| 11,300 | 8,000 | 144 Evolution of new varieties of Mango, grapes & Citrus, Pb. | 8,000·00 | .. | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. (i) *Agriculture*—contd. (d) Fruits—*concld.* | | | |
| 3,900 | .. | 145 Physiological studies on factors governing root formation in cutting and layering of fruits Calcutta University. | .. | .. | .. |
| 59,700 | 18,200 | 146 Co-ordinated Scheme for the improvement of muskmelon and water melon I.A.R.I. | 18,200·00 | .. | .. |
| 8,500 | 11,800 | 147 Research on Cashew-nuts, Mysore. | 11,741·00 | (+) 59·00 | (*a*) |
| 7,920 | 4,600 | 148 Research on Cashew-nuts, Kerala. | 4,529·37 | (+) 70·63 | (*a*) |
| 9,510 | .. | 149 Control of serious diseases of gua, Ajmer (Rajasthan). | .. | .. | .. |
| | | (e) Vegetables | | | |
| 7,650 | 5,300 | 150 Tuber Crops, Bihar | 5,220·00 | (+) 80·00 | (*a*) |
| 1,000 | .. | 151 Tuber Crops, Orissa.. | .. | .. | .. |
| .. | 2,500 | 152 Tuber Crops, Mysore | 2,500·00 | .. | .. |
| 7,840 | 6,500 | 153 Investigation on pests of vegetables, Andhra. | 6,500·00 | .. | .. |
| 6,000 | 4,000 | 154 Tuber Crops, Madras | 3,921·00 | (+) 79·00 | (*a*) |
| .. | 100 | 155 Tuber Crops, Andhra | 75·00 | (+) 25·00 | (*a*) |
| 6,600 | 6,000 | 156 Tuber Crops and related plants T. University. | 5,990·37 | (+) 9·63 | (*a*) |
| 36,300 | 31,400 | 157 Tapioca and sweet potato, Travancore, Cochin (Kerala). | 31,360·0 | (+) 40·00 | (*a*) |
| 10,900 | 7,900 | 158 Improvement of Vegetables, Bombay. | 7,870·00 | (+) 30·00 | (*a*) |
| 15,400 | 13,400 | 159 Improvement of Vegetables, U.P. | 13,390·28 | (+) 9·72 | (*a*) |
| 10,900 | 9,300 | 160 Improvement of Vegetables, Pepsu (Punjab). | 9,240·00 | (+) 60·00 | (*a*) |
| 11,450 | 3,400 | 161 Establishment of Vegetables Research Station, Andhra. | 3,400·00 | .. | .. |
| 11,300 | .. | 162 Establishment of Vegetables Research Station, Orissa. | .. | .. | .. |
| 5,600 | 2,000 | 163 Onion Research, Andhra. | 2,000·00 | .. | .. |
| 4,420 | .. | 164 Improvement of onion and garlic. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*i*) *Agriculture*—contd. | | | |
| | | (e) Vegetables—*contd.* | | | |
| 13,300 | 11,700 | 165 Improvement of Vegetables Madras. | 11,694·00 (+) | 6·00 | (*a*) |
| 11,400 | .. | 166 Improvement of Vegetables Kashmir. | .. | .. | .. |
| 7,300 | 5,900 | 167 Improvement of Vegetables Punjab. | 5,830·37 (+) | 69·63 | (*a*) |
| 11,000 | 26,000 | 168 Improvement of Vegetables Hyderabad (Andhra). | 25,930·00 (+) | 70·00 | (*a*) |
| 10,200 | 10,000 | 169 Improvement of Vegetables W. Bengal. | 10,000·00 | .. | .. |
| 9,400 | 5,700 | 170 Improvement of Vegetables M. P. | 5,676·00 (+) | 24·00 | (*a*) |
| 6,800 | 4,300 | 171 Improvement of Vegetables V.P. | 4,236·28 .. | 63·72 | (*a*) |
| 7,900 | 8,300 | 172 Improvement of Vegetables H.P. | 8,511·75 (—) | 211·75 | (*a*) |
| | | (*f*) Other Crops | | | |
| — | 600 | 173 Survey of Insects and pests of stored pepper, Travancore Cochin. | 530·00 (+) | 70·00 | (*a*) |
| 10,300 | 10,000 | 174 Chillies Research I.A. R.I. | 9,969·31 (+) | 30·69 | (*a*) |
| 4,300 | — | 175 Chillies Research Bombay. | .. | .. | .. |
| — | .. | 176 Chillies Research Madras. | 3,000·00 (—) | 3,000·00 | .. |
| 4,000 | .. | 177 Ergot Production Madras. | .. | .. | .. |
| 12,300 (m) | — | 178 Spike diseases of Sandal Wood I.A. R.I. | .. | .. | .. |
| 7,000 | 6,500 | 179 Development of pepper Madras. | 6,496·00 (+) | 4·00 | .. |
| 5,210 | 3,500 | 180 Research on pests and diseases of Cashewnut, Madras. | 3,421·00 (+) | 79·00 | (*a*) |
| — | 9,500 | 181 Turmeric, Orissa. .. | 1,250·00 (—) | 8,250·00 | This error is due to mistake in totalling at the time of reappropriation. |
| 8,900 | 8,000 | 182 Cardamoms, W. Bengal. | 8,000·00 | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (f) Other Crops—*contd.* | | | |
| 17,000 | 13,500 | 183 Pepper, Madras .. | 13,443·20 | (+) 56·80 | (a) |
| 3,500 | 4,300 | 184 Ginger, Madras .. | 4,218·00 | (+) 82·00 | (a) |
| 7,610 | 4,800 | 185 Zira Diseases Rajasthan. | 4,800·00 | .. | .. |
| 13,100 | .. | 186 Medicinal Plants Assam | .. | .. | .. |
| 31,700 | 14,000 | 187 Medicinal Plants F.R.I. | 14,000·00 | .. | .. |
| 9,900 | 9,000 | 188 Medicinal Plants Kashmir. | 9,000·00 | .. | .. |
| 13,400 | 11,400 | 189 Medicinal Plants W. Bengal. | 11,400·00 | .. | .. |
| 13,500 | .. | 190 Medicinal Plants H. P. | .. | .. | .. |
| .. | 2,700 | 191 Cashewnut M.P.(M.P.) | 2,260·00 | (+) 440·00 | (a) |
| .. | .. | 192 Development of Cashewnut M.P. | 359·00 | (—) 359·00 | (a) |
| 2,200 | 900 | 193 Cultivation and development of Ginger Travancore Cochin (Kerala.) | 865·25 | (+) 34·75 | (a) |
| 4,200 | 4,000 | 194 Spices W. Bengal .. | 4,000·00 | .. | .. |
| 10,500 | 11,000 | 195 Cloves Nutmeg and Coco Madras. | 11,000·00 | .. | .. |
| 8,800 | 9,500 | 196 Turmeric Research (Revised) Orissa. | 10,338·00 | (—) 838·00 | (a) |
| 1,30,000 | 56,000 | 197 Botanical improvement of the essential oil yielding plants I.A.R.I. | 56,000·00 | .. | (a) |
| 18,000 | 23,000 | 198 Establishment of a Research station for cardamom (Kerala). | 23,000·00 | .. | .. |
| 19,400 | .. | 199 Establishment of a Research station for cardamom Mysore | .. | .. | .. |
| 26,500 | .. | 200 Establishment of Research Station of pepper (Kerala). | .. | .. | .. |
| 5,800 | 5,000 | 201 Turmeric Andhra .. | 5,000·00 | .. | .. |
| 5,600 | 5,000 | 202 Ginger Assam .. | 5,000·00 | .. | .. |
| 10,490 | 4,500 | 203 Ergot Production W. Bengal. | 4,436·56 | (+) 63·44 | (a) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (f) Other Crops—*concld.* | | | |
| 3,600 | 1,300 | 204 Ergot production Assam. | 1,218·00 | (+) 82·00 | (a) |
| .. | 100 | 205 Investigation of insect infestation of pepper exported to U.S.A. & Madras. | 99·00 | (+) 1·00 | (a) |
| 24,000 | 6,800 | 206 Composite Research station for pepper and cardamom and Cashewnut Assam. | 6,750·00 | (+) 50·00 | (a) |
| 4,200 | .. | 207 Chillies U.P. .. | .. | .. | .. |
| 4,100 | .. | 208 Chillies W. Bengal .. | .. | .. | .. |
| 3,800 | 800 | 209 Chillies M.P. .. | 760·00 | (+) 40·00 | (a) |
| 9,090 | 6,200 | 210 Chillies Andhra .. | 6,175·00 | (+) 25·00 | (a) |
| 4,600 | 1,400 | 211 Chillies Hyderabad | 1,400·00 | .. | .. |
| 3,600 | 9,500 | 212 Chillies Madras .. | 9,411·00 | (+) 89·00 | (a) |
| 23,600 | .. | 213 Improvement of Paddy I.A.R.I. | .. | .. | — |
| 5,800 | .. | 214 Control of Hairy Caterpillar Cardamom of Coorg. | .. | — | — |
| 7,070 | .. | 215 Improvement of Lemon grass Kerala. | .. | .. | .. |
| 2,990 | 1,400 | 216 Research on pepper and Cardamom Orissa. | 1,320·00 | (+) 80·00 | (a) |
| 2,950 | 800 | 217 Research on pan M.P. | 784·19 | (+) 15·81 | (a) |
| 2,840 | 1,800 | 218 Research on pan Madras. | 1,800·00 | .. | — |
| 6,820 | .. | 219 Root Crops W. Bengal | .. | .. | .. |
| 9,330 | 6,700 | 220 Spices Delhi University. | 6,700·00 | .. | .. |
| | | (g) Soils and Manures | | | |
| 10,030 | 2,200 | 221 Micronutrients studies Punjab. | 2,170·00 | (+) 30·00 | (a) |
| 5,740 | .. | 222 Collection of Soil Survey. I.A.R.I. | .. | .. | .. |
| 11,900 | .. | 223 Usarland Reclamation Punjab. | 10,000·0 | (—)10,000·00 | .. |
| 15,420 | 12,500 | 224 Soil standardisation method Bombay. | 12,415·00 | (+) 85·00 | (a) |
| 3,250 | 6,500 | 225 Soil and plant growth Agra. | 6,490·00 | (+) 10·00 | (a) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (g) Soils and Manures—*contd.* | | | |
| .. | 200 | 226 Nitrogen fixation in Soils, I.A.R.I. | 173·00 | (+) 27·00 | (a) |
| 360 | 100 | 227 Nitrogen fixation in Soils, M.P. | 60·00 | (+) 40·00 | (a) |
| 17,800 | 4,000 | 228 Folian application of nutrient to crops I.A.R.I. | 4,000·00 | .. | .. |
| 2,120 | .. | 229 Research on demineralisation of water, Punjab. | .. | .. | .. |
| 46,830 | .. | 230 Study of fertility index of soils field Research station Bombay. | 35,000·00 | (—)35,000·00 | .. |
| 11,070 | .. | 231 Investigation of Kharland in Bombay State Bombay. | .. | .. | .. |
| 25,630 | .. | 232 Reclamation of saline soils W. Bengal. | .. | .. | .. |
| .. | 5,300 | 233 Soil conservation, H.P. | 5,218·00 | (+) 82·00 | (a) |
| 1,600 | 5,200 | 234 Nitrogen Fixation in Soil Sheila Dhar Institute. | 5,200·00 | .. | .. |
| 170 | .. | 235 Rapid Soil Test I.A.R.I. | .. | .. | .. |
| 2,390 | .. | 236 Green Manure, U.P. | .. | .. | .. |
| 16,350 | 15,000 | 237 Studies in the cost of reclamation of Kalar (Alkali) lands, Khalsa College, Amritsar. (Pb.). | 15,000·00 | .. | .. |
| 5,160 | 5,000 | 238 Possibilities of using carbons in improvement and reclamation of soils Punjab University. | 5,000·00 | .. | .. |
| 4,200 | 3,600 | 239 Green manuring Crops Bihar. | 3,560·00 | (+) 40·00 | (a) |
| 8,400 | .. | 240 Green manuring Crops C.R.R.I. | .. | .. | .. |
| 9,000 | .. | 241 Green manuring Crops I.C.J.C. | .. | .. | .. |
| 10,500 | 7,300 | 242 Alkali Reclamation Andhra. | 7,300·00 | .. | .. |
| 4,500 | .. | 243 Clay mineral contents of Indian soil W. Bengal. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (g) Soils and Manures—*contd.* | | | |
| 5,000 | 8,900 | 244 Soil conditioners W. Bengal. | 8,900·00 | .. | .. |
| 3,300 | 3,000 | 245 Legume seed inoculation W. Bengal. | 3,000·00 | .. | .. |
| 5,700 | 4,700 | 246 Nitrogen fixation, Andhra. | 4,700·00 | .. | .. |
| 64,900 | 20,000 | 247 Usarland reclamation Lucknow. | 20,000·00 | .. | .. |
| 9,200 | 2,500 | 248 Composition of plants in Usarlands Lucknow University. | 11,200·00 | (—) 8,700·00 | Due to mistake in totalling at the time of re-appropriation. |
| 4,900 | 1,100 | 249 Phosphatic reversion in Nilgries Madras. | 1,090·00 | (+) 10·00 | (*a*) |
| 56,290 | .. | 250 Salinity and alkalinity control in Punjab soils Punjab. | .. | .. | .. |
| 2,870 | .. | 251 Soil structure in Punjab soils, Punjab. | .. | .. | .. |
| 7,800 | 7,500 | 252 Reclamation of Saline and Alkaline Lands Madras. | 7,500·00 | .. | .. |
| 3,400 | 3,500 | 253 Phosphorous Nutrition of crops Andhra. | 3,490·00 | (+) 10·00 | (*a*) |
| 6,200 | 3,000 | 254 Nitrogen fixation Bombay. | 2,990·00 | (+) 10·00 | (*a*) |
| .. | 3,600 | 255 Simple Fertilizer trials Punjab (Nawanshehar). | 36,000·00 | (—) 32,400·00 | The figures of expenditure was taken as Rs. 3,600 instead of Rs. 36,000 at the time of reappropriation. |
| .. | .. | 256 Simple Fertilizer trials Punjab (Nilokheri). | .. | .. | |
| .. | 10,000 | 257 Simple Fertilizer trials Mhow (M.P.). | 10,000·00 | .. | .. |
| .. | 10,000 | 258 Simple Fertilizer trials Rajasthan (Sumerpur). | 10,000·00 | .. | .. |
| .. | 4,000 | 259 Simple Fertilizer trials Bombay. | 3,954·00 | (+) 46·00 | (*a*) |
| .. | 11,300 | 260 Simple Fertilizer trials Kerala. | 11,300·00 | .. | .. |
| .. | 21,300 | 261 Simple Fertilizer trials Mangalore (Mysore). | 21,260·00 | (+) 40·00 | (*a*) |
| .. | 18,000 | 262 Simple Fertilizer trials Punjab (Bhadson). | 18,000·00 | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*i*) *Agriculture*—contd. | | | |
| | | (g) Soils and Manures—*contd.* | | | |
| .. | 8,000 | 263 Simple Fertilizer trials I.A.R.I. | 7,953·00 | (+) 47·00 | (*a*) |
| 4,200 | .. | 264 Model Agronomic Experiments Hyderabad (Mysore). | .. | (+) .. | .. |
| .. | 8,000 | 265 Model Agronomic Experiments Assam. | 8,000·00 | .. | .. |
| .. | 9,000 | 266 Model Agronomic Experiments Punjab (Nasirpur). | 9,000·00 | .. | .. |
| .. | 9,600 | 267 Model Agronomic Experiments Punjab (Sirsa). | 9,602·00 | (—) 2·00 | (*a*) |
| .. | 8,000 | 268 Model Agronomic Experiments M.B. | 8,000·00 | .. | .. |
| .. | 7,400 | 269 Model Agronomic Experiments Andhra (Chimagonehal). | 7,351·00 | (+) 49·00 | (*a*) |
| .. | 14,600 | 270 Model Agronomic Experiments Kerala. | 14,586·75 | (+) 13·25 | (*a*) |
| .. | 17,100 | 271 Model Agronomic Experiments Orissa (Rajpur and Pomerkhera). | 17,070·00 | (+) 30·00 | (*a*) |
| 3,650 | .. | 272 Model Agronomic Experiments Satna M.P. | .. | .. | .. |
| 1,660 | 5,800 | 273 Model Agronomic Experiments Akola (Bombay). | 5,780·00 | (+) 20·00 | (*a*) |
| 1,400 | 5,000 | 274 Model Agronomic Experiments Urala (Bombay). | 5,000·00 | .. | .. |
| 1,300 | 10,000 | 275 Model Agronomic Experiments Mysore (Virapura). | 10,000·00 | .. | .. |
| 900 | .. | 276 Model Agronomic Experiments Abdulaganj (M.P.). | .. | .. | .. |
| .. | .. | 277 Model Agronomic Experiments Barapath. | 9,500·00 | (—) 9,500·00 | .. |
| .. | 15,000 | 278 Model Agronomic Experiments Aligarh (U.P.). | 15,000·00 | .. | .. |
| 2,290 | 18,000 | 279 Model Agronomic Experiments Nurdean (W. Bengal). | 18,000·00 | .. | .. |
| .. | 9,100 | 280 Model Agronomic Experiments Bombay (Karjah and Lakhampur). | 9,090·00 | (+) 10·00 | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (g) Soils and Manures—*contd.* | | | |
| .. | 10,000 | 281 Model Agronomic Experiments Orissa (Sahaspur). | 10,000·00 | .. | .. |
| .. | 5,000 | 282 Model Agronomic Experiments M.P. ( Bhagwai). | 5,000·00 | .. | .. |
| 85,940 | .. | 283 Model Agronomic Experiments other centres. | | .. | .. |
| 1,320 | 9,600 | 284 Model Agronomic Experiments Maruteru (Andhra). | 9,510·00 (+) | 90·00 | (*a*) |
| 1,060 | 15,700 | 285 Model Agronomic Experiments Chalvoi (Andhra). | 15,670·00 (+) | 30·00 | (*a*) |
| 1,200 | 11,600 | 286 Model Agronomic Experiments Coorg (Poonampat). | 11,567·00 (+) | | .. |
| 3,350 | 20,000 | 287 Model Agronomic Experiments Kanpur & Banaras (U.P.). | 20,000·00 | .. | .. |
| 1,270 | 9,600 | 288 Model Agronomic experiments Adutharai Madras. | 9,567·00 (+) | 33·00 | (*a*) |
| 1,290 | 5,000 | 289 Model Agronomic Experiments Ganganagar (Rajasthan). | 5,000·00 | .. | .. |
| 3,700 | 2,800 | 290 Green Manuring Crops H.P. | 2,750·00 (+) | 50·00 | (*a*) |
| 3,500 | 4,200 | 291 Green Manuring Crops Hyderabad (Andhra). | 4,116·00 (+) | 84·00 | (*a*) |
| 2,950 | 2,500 | 292 Green Manuring crops Mysore. | 2,500·00 | .. | .. |
| 15,370 | 8,300 | 293 Micronutrients status of soils Bombay. | 8,260·00 (+) | 40·00 | (*a*) |
| 1,600 | 5,200 | 294 Usarland reclamation Sheilladhar Institute. | 5,200·00 | .. | .. |
| 6,740 | 1,600 | 295 Studies in microflora of Soils I.I.Sc. Bangalore. | 1,598·00 (+) | 2·00 | (*a*) |
| .. | 10,400 | 296 Manurial Experiments (Madras). | 10,404·00 (—) | 4·00 | (*a*) |
| .. | 4,700 | 297 Manurial Experiments Bombay. | 4,650·00 (+) | 50·00 | (*a*) |
| 4,730 | .. | 298 Availability & fixation of phosphorous in the Punjab soils Ludhiana (Punjab). | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (g) Soils and Manures—*concld.* | | | |
| 1,390 | .. | 299 Azatabactor inoculation of crops, W. Bengal. | .. | .. | .. |
| 6,400 | .. | 300 Studies on Nitrogen fixation power of important leguminous crops, Madras. | .. | .. | .. |
| 7,870 | .. | 301 Intake of different farms of phosphate by Green manuring crops, Madras. | .. | .. | .. |
| 5,160 | 5,000 | 302 Standardization of methods of determining. 1. Surface area and 2. P.M. value of soil Punjab University. | 5,000·00 | .. | .. |
| .. | .. | 303. Salinity Research B.R. College. | 1,600·00 | (—)1,600·00 | (a) |
| | | (h) Agronomy | | | |
| 1,400 | 100 | 304 Phenological observations Poona. | 18·00 | (+) 82·00 | (a) |
| 18,000 | .. | 305 Water requirements of Crops at Central Field Research Station Poona. | .. | .. | .. |
| 15,400 | .. | 306 Agronomic aspects of Jowar Amravati M.P. | .. | .. | .. |
| 10,800 | 10,000 | 307 Sprinkling irrigation Coorg (Mysore). | 10,000·00 | .. | .. |
| 8,700 | 6,900 | 308 Agronomic aspects of Green manuring Bombay. | 6,850·00 | (+) 50·00 | (a) |
| 9,500 | .. | 309 Water requirement of Crops D.V.C. | .. | .. | .. |
| .. | 500 | 310 Supplement to the Monograph on Dry Farming in India, Bombay. | 496·00 | (+) 4·00 | (a) |
| | | (i) Physiology | | | |
| .. | 700 | 311 Cytological studies on crop plants, Andhra University. | 660·00 | (+) 40·00 | (a) |
| 21,200 | 15,600 | 312 Use of phytohormones for higher yield, Bombay. | 15,550·00 | (+) 50·00 | (a) |
| 10,500 | 8,300 | 313 Chemical stimulation of ovules, Delhi University. | 8,260·00 | (+) 40·00 | (a) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*i*) *Agriculture*—contd. | | | |
| | | (i) Physiology—*contd.* | | | |
| 50,300 | 43,800 | 314 Plant physiology & sub-station Plant introduction Bureau-Vivekananda Laboratory U.P. | 43,746·00 | (+) 54·00 | (*a*) |
| | | (j) Entomology | | | |
| 11,400 | 9,900 | 315 Intensification of Termite Research, Anand. | 7,100·00<br>2,710·00 | (+) 90·00 | (*a*) |
| 2,100 | 1,500 | 316 Investigating the use of distress called of birds feeding of grain Crops Bombay. | 1,480·00 | (+) 20·00 | (*a*) |
| 9,600 | 10,500 | 317 Nutritional & Biological studies on Insects, Delhi University. | 10,500·00 | .. | .. |
| 9,000 | 6,200 | 318 Systematic & Biological studies of ardent fauna, Delhi University. | 6,180·00 | (+) 20·00 | (*a*) |
| 10,000 | 18,900 | 319 Augmenting the marmed insect Collection Agriculture College Coimbatore. | 18,860·00 | (+) 40·00 | (*a*) |
| 6,700 | 6,600 | 320 Physiological relationship between insects and their hosts plants Agri. College Coimbatore | 6,600·00 | .. | (*a*) |
| 6,170 | 3,000 | 321 Study of the rates of decomposition of the insecticides deposits Osmania Uty. Hyderabad. | 3,000·00 | .. .. | .. |
| 34,680 | .. | 322 Research on fungicides I.A.R.I. | .. | .. .. | .. |
| 33,000 | 26,300 | 323 Exploration of Toxicity hazards in the use of modern insecticides. | .. | .. .. | .. |
| 42,100 | .. | 324 Exploration of Toxicity hazards in the use of modern insecticides of cattle and human beings I.V.R.I. | 26,270·00<br>.. | (+) 30·00<br>.. | (*a*)<br>.. |
| 4,100 | .. | 325 School of Research P.P.A. | .. | .. .. | .. |
| 6,050 | .. | 326 Scheme for studies on Aphidal W. Bengal. | .. | .. .. | .. |
| 9,240 | .. | 327 Work on bio-essay and other techniques in the study of Plant diseases Madras University. | .. | .. .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (i) *Agriculture*—contd. | | | |
| | | (j) Entomology—*contd.* | | | |
| 4,140 | .. | 328 Research on toxicity and adverse effect of Synthetic pesticides. | .. | .. | .. |
| .. | 3,900 | 329 School of Research Malaria Institute. | 3,871·00 (+) | 29·00 | (*a*) |
| 4,020 | .. | 330 School of Research I.A.R.I. under Dr. Narayanan. | .. | .. | .. |
| 4,100 | .. | 331 Control of neinatoes on betelvine in Nasik Distt. Bombay. | .. | .. | .. |
| .. | 2,900 | 332 Weed Control H.P. | 2,861·00 (+) | 39·00 | (*a*) |
| .. | 1,000 | 333 Weed control W. Bengal (Bose Instt.) | 950·00 (+) | 50·00 | (*a*) |
| 23,000 | 2,000 | 334 Termite Research F.R.I. | 2,000·00 .. | .. | .. |
| 10,600 | 8,600 | 335 Termite Research I.A.R.I. | 8,520·00 (+) | 80·00 | (*a*) |
| 2,870 | .. | 336 Test with D.D.T. I.A.R.I. | .. | .. | .. |
| 5,880 | 2,000 | 337 Building up named reference collection of insect pests at the Agricultural College Baptala (Andhra). | 2,000·00 .. | .. | .. |
| 34,800 | 15,000 | 338 Fundamental Research on toxicity and mode of action of insecticides Punjab University College Hoshiarpur. | 15,000·00 .. | .. | .. |
| | | (k) Mycology | | | |
| 16,750 | .. | 339 Virus diseases, Poona | .. | .. | .. |
| 8,200 | .. | 340 Development of Herbarium cryptogeamal orientals I.A.R.I. | .. | .. | .. |
| 26,800 | 8,800 | 341 Co-ordinated Plant Virus scheme Eastern Zone I.A.R.I. | 8,760·00 (+) | 40·00 | (*a*) |
| 4,840 | 9,200 | 342 Control of Bundha Parasite B. R. College, Agra. | 9,110·00 (+) | 90·00 | (*a*) |
| 2,800 | .. | 343 School of Research F.R.I. | .. | .. | .. |
| 4,100 | .. | 344 School of Research Anand. | .. | .. | .. |
| 4,100 | .. | 345 School of Research I.A.R.I. under Dr. Vasudeva. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*i*) *Agriculture*—concld. | | | |
| | | (l) Floriculture | | | |
| 28,100 | .. | 346 Cytogenitical and Physiological Studies in relation to floriculture I.A.R.I. | .. | .. | .. |
| 11,520 | .. | 347 Research and development on floriculture, Punjab (Pepsu). | .. | .. | .. |
| 3,480 | .. | 348 Cultivation of lotus U.P. | .. | .. | .. |
| | | (m) General | | | |
| | 1,000 | 349 Survey of Fertilizer Practices, Andhra. | 959·00 (+) | 41·00 | (*a*) |
| | 1,800 | 350 Survey of Fertilizer Practices, Madras. | 1,782·00 (+) | 18·00 | (*a*) |
| 1,600 | 8,300 | 351 Survey of Fertilizer Practices, U.P. | 8,245·00 (+) | 55·00 | (*a*) |
| 680 | .. | 352 Pre-soaking seeds in nutrient salt, Madras. | .. | .. | .. |
| | 1,500 | 353 Monograph on Agriculture in ancient India, I.A.R.I. | 1,500·00 .. | .. | .. |
| 17,300 | 11,800 | 354 Studies of genetics & variability of Algae, I.A.R.I. | 11,810·00 (—) | 10·00 | (*a*) |
| 20,500 | .. | 355 Pre-soaking seed in nutrient salt, Indore. | .. | .. | .. |
| 5,140 | 8,300 | 356 Pre-soaking seed in nutrient salt, Vivekananda Lab. Almora. | .. | .. | .. |
| | | | 8,302·00 (—) | 2·00 | (*a*) |
| 8,440 | 6,300 | 357 Pre-soaking seed in nutrient salt, I.A.R.I. | 6,260·00 (+) | 40·00 | (*a*) |
| 2,300 | 7,100 | 358 Survery of fertilizer practices, Punjab. | 7,080·00 (+) | 20·00 | (*a*) |
| 4,800 | .. | 359 Survey of fertilizer Practices, M.P. | .. | .. | .. |
| | | (*ii*) *Animal Husbandry* | | | |
| | | (*a*) Cattle Breeding | | | |
| 28,840 | .. | 1 Livestock investigation, Punjab. | .. | .. | .. |
| 24,600 | 7,100 | 2 Immune Genetics of Indian Cattle, I.V.R.I. | 7,100·00 .. | .. | .. |
| 27,000 | .. | 3 Fundamental study of quantitative inheritance, I.V.R.I. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 3 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (a) Cattle Breeding—*contd.* | | | |
| 21,180 | 35,400 | 4 Improvement of Kangayam breed of cattle, Madras. | 35,350·00 | (+) 50·00 | (*a*) |
| 69,360 | 59,800 | 5 Causes of degeneration of Indian Cattle I.V.R.I. | 59,800·00 | .. .. | .. |
| 35,000 | 34,000 | 6 Comparative study of selective breeding of Purnea, Bihar. | 34,000·00 | .. .. | .. |
| 45,000 | 1,900 | 7 Selective breeding and grading up of cattle, W. Bengal. | 1,895·89 | (+) 4·11 | (*a*) |
| 2,01,700 | .. | 8 Evaluation of new breed of dairy cattle by crossing Hariana cows with Jersey Bulls, W. Bengal. | .. | .. .. | .. |
| 14,350 | 2,200 | 9 Thickness of skin and distribution of sweat glands of buffaloes in relation to milk production, I.V.R.I. | 2,200·00 | .. .. | .. |
| 1,69,590 | 10 | 10 Camel farm for the Bikaneri breed and opening of 10 key village centres, Rajasthan. | .. | (+) 10·00 | (*a*) |
| 15,010 | .. | 11 Evolving of a new type of pigs by cross breeding U.P. | .. | .. .. | .. |
| 15,500 | 4,400 | 12 Evolving methods of sterilization of scrub cows I.V.R.I. | 4,380·00 | (+) 20·00 | (*a*) |
| 71,360 | 17,000 | 13 Evolving suitable draught capacity measures for bullocks, I.V.R.I. | 16,900·00 | (+) 100·0 | (*a*) |
| 20,000 | 20,000 | 14 Selective breeding and grading up of cattle (Kaira type) Orissa. | 20,000·00 | .. .. | .. |
| .. | 800 | 15 Metabolic effects of harmones in relation to induced lactation U.P. | 730·00 | (+) 70·00 | .. |
| 28,440 | .. | 16 Relative value of selective breeding and grading up of umblachery cattle, Madras. | 3,300·00 | (—) 3,300·00 | (*g*) |
| 5,990 | .. | 17 Determining the age of maturity of Indian Bulls, Orissa. | .. | .. .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | (*b*) *Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (a) Cattle Breeding—*contd.* | | | |
| 2,25,240 | .. | 18 Rearing of, sex behaviour of, breeding of bulls, Madras. | .. | .. | .. |
| .. | .. | Rearing of, sex behaviour of, breeding of bulls N.D.R.I. | .. | .. | .. |
| .. | .. | Rearing of, sex behaviour of, breeding of bulls, other centres. | .. | .. | .. |
| 8,400 | 5,000 | 19 Physiology of hump development and sheath of cattle—veterinary College Calcutta Bengal. | 5,000·00 | .. | — |
| 43,460 | .. | 20 Physiological Genetics of Cattle, W. Bengal. | .. | .. | .. |
| 35,000 | 16,000 | 21 Selective breeding and grading up of indigenous cattle, Orissa. | 16,000·00 | .. | — |
| 52,600 | .. | 22 Cattle Breeding Research, H.P. | .. | .. | — |
| .. | 2,700 | 23 Definition of breed characteristics of Amrit Mahal and Hailikar Cattle Mysore. | 2,194·00 | (+) 6·00 | (*a*) |
| 59,000 | 19,100 | 24 Co-ordinated Cattle Sterility Osmania University. | 19,090·00 | (+) 10·00 | (*a*) |
| 86,000 | 32,000 | 25 Artificial Insemination, I.D.R.I. | 32,000·00 | .. | .. |
| 39,160 | .. | 26 Progeny Testing of Murrah Buffaloes Bulls, Bombay. | .. | .. | — |
| 81,650 | .. | 27 Investigation on the Progeny testing of bulls under Indian Conditions, 2 Units. | .. | .. | — |
| 11,000 | 2,100 | 28 Cross breeding of Cattle, Andhra. | 2,033·00 | (+) 67·00 | (*a*) |
| 10,000 | 11,000 | 29 Cross breeding of Cattle, Assam. | 11,000·00 | .. | — |
| 12,000 | 19,200 | 30 Cross breeding of Cattle, Madras. | 19,135·00 | (+) 65·00 | (*a*) |
| 12,000 | 8,800 | 31 Cross breeding of Cattle, Bihar. | 8,713·00 | (+) 87·00 | (*a*) |
| 13,000 | 28,000 | 32 Cross breeding of Cattle, Andhra. | 27,840·00 | (+) 60·00 | (*a*) |
| 40,150 | .. | 33 Cross breeding of Cattle, W. Bengal. | .. | .. | — |
| 3,550 | 300 | 34 Physiological norms of Indian Cattle, W. Bengal. | 250·00 | (+) 50·00 | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (a) Cattle Breeding—*concld.* | | | |
| 86,050 | .. | 35 Selective breeding Vs. grading up of Martvada buffaloes, Andhra. | .. | .. | .. |
| 13,000 | .. | 36 Cross breeding of cattle, Punjab. | .. | .. | .. |
| 30,000 | 7,800 | 37 Cross breeding of cattle, Kerala. | 7,710·00 | (+) 90·00 | (*a*) |
| 31,400 | .. | 38 Cross breeding of local non-descript cattle, Andhra. | .. | .. | .. |
| 15,000 | 400 | 39 Cross breeding of cattle in heavy rainfall areas (Neyyatmkara centre) Kerala. | 400·00 | .. | .. |
| 23,220 | .. | 40 Scheme for investigation of the possibility of spreading out the breeding season in buffaloes, I.V.R.I. | .. | .. | .. |
| 43,920 | .. | 41 Scheme for investigating the Comparative value of grading up with Sindhi Bulls and Cross breeding with Jersey Bulls for increased milk production, Kerala. | .. | .. | .. |
| | | (b) Goat and Sheep Breeding | | | |
| 10,000 | 7,400 | 42 Development of mutton breeds of sheep, Bombay. | 7,404·00 | (—) 4·0 | (*a*) |
| 20,000 | .. | 43 Development of mutton breeds of sheep, Madras. | .. | .. | .. |
| 8,340 | .. | 44 Goat Breeding, Punjab | .. | .. | .. |
| 6,600 | 8,100 | 45 Goat Breeding, U.P. | 8,100·00 | .. | .. |
| 11,000 | 6,000 | 46 Sheep Research Station, Punjab. | 112·00 | (—) 2·00 | (*a*) |
| .. | .. | 47 Meat and Mohair Goat, Bombay. | 5,890·00 | | |
| 6,400 | .. | 48 Improvement of sheep in Hills, W. Bengal. | .. | .. | .. |
| 3,040 | .. | 49 Improvement of goat, Kerala. | .. | .. | .. |
| 10,000 | 100 | 50 Improvement of goat, W. Bengal. | 26·25 | (+) 73·75 | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grants-in-aid*—contd. | | | |
| | | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | | (b) Goat and Sheep Breeding—*contd.* | | | |
| 19,260 | .. | 51 | Exploring the possibilities of Mohair production, Andhra. | .. | .. | .. |
| 12,890 | .. | 52 | Development of mutton breeds of sheep, Andhra. | .. | .. | .. |
| 600 | .. | 53 | Definition of breeds of sheep, Rajasthan. | .. | .. | .. |
| 22,690 | 32,400 | 54 | Sheep and wool improvement on regional basis, U.P. | 32,324·00 | (+) 76·00 | (*a*) |
| 35,610 | 8,200 | 55 | Sheep and wool improvement on regional basis, Bombay (Joria Centre). | 8,130·00 | (+) 70·00 | (*a*) |
| 7,390 | 10,000 | 56 | Sheep and wool improvement on regional basis, Bihar. | 10,000·00 | .. | .. |
| 20,000 | 20,600 | 57 | Sheep and wool improvement on regional basis, Madras Revised. | 20,530·00 | (+) 70·00 | (*a*) |
| 20,000 | .. | 58 | Sheep and wool improvement on regional basis, Rajasthan. | .. | .. | .. |
| 34,000 | .. | 59 | Sheep and wool improvement on regional basis, H.P. | .. | .. | .. |
| 29,210 | .. | 60 | Sheep and wool improvement on regional basis, other centres. | .. | .. | .. |
| 42,000 | 24,000 | 61 | Sheep and wool improvement on regional basis, Jammu & Kashmir. | 24,000·00 | .. | .. |
| 11,100 | .. | 62 | Sheep and wool improvement on regional basis, Mysore. | .. | .. | .. |
| 14,540 | 24,000 | 63 | Sheep and wool improvement on regional basis, Bombay (Poona). | 25,053·69 | (—) 153·69 | (*a*) |
| 18,000 | .. | 64 | Development of strains of goats for milk production, Bombay. | .. | .. | .. |
| 4,180 | .. | 65 | Defining characteristics of breeds of sheep, Bombay. | .. | .. | .. |
| 3,500 | .. | 66 | Normal worm burden in sheeps and wool, Punjab. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (ii) *Animal Husbandry*—contd. | | | |
| | | (c) Animal Nutrition | | | |
| .. | 2,300 67 | Animal Nutrition, Assam | 2,266·00 | + 34·00 | (a) |
| 26,800 | .. 68 | Animal Nutrition, Punjab. | .. | .. | .. |
| 70,000 | 62,500 69 | Animal Nutrition, Bombay. | 62,562·00 | (—) 62·00 | (a) |
| 70,000 | 57,000 70 | Animal Nutrition, I.D.R.I. | 57,000·00 | .. | .. |
| 39,010 | .. 71 | Animal Nutrition, W. Bengal. | .. | .. | .. |
| 50,540 | 18,800 72 | Utilization of waste production for feeding of Cattle, Orissa. | 18,800·00 | .. | .. |
| 72,000 | 13,500 73 | Urea as a protein substitute I.V.R.I. | 13,500·00 | .. | .. |
| 50,000 | 38,700 74 | Influence of trace elements on the health and production capacity of livestock, I.V.R.I. | 38,700·00 | .. | .. |
| 40,000 | 21,000 75 | Further work on paddy straw, I.V.R.I. | 21,000·00 | .. | .. |
| 23,000 | 20,000 76 | Nutrition requirements of buffaloes, Agra. | 20,000·00 | .. | .. |
| 6,000 | .. 77 | Survey of the deficiency diseases of livestock, W. Bengal. | .. | .. | .. |
| .. | 100 78 | Preparation of a Compendium on the animal nutrition investigation, W. Bengal. | 50·00 | (+) 50·00 | (a) |
| 40,000 | .. 79 | Studies on food requirements of sheep under range and Agricultural conditions, I.V.R.I. | .. | .. | .. |
| 9,360 | .. 80 | Co-ordinating Officer, Animal Nutrition, I.V.R.I. | .. | .. | .. |
| 60,000 | .. 81 | Animal Nutrition Stations-provision for Jeeps etc. (to be allotted to various centres). | .. | .. | .. |
| 36,690 | .. 82 | Scheme on the investigation on the nutritional requirements of pigs. I.V.R.I. | .. | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (c) Animal Nutrition—*contd.* | | | |
| 32,150 | .. | 83 Investigation on the quality of wool and meat in relation to nutrition of sheep. B.R. College, Agra. | .. | .. | .. |
| | | (d) Animal Pests Diseases and Cure. | | | |
| 7,590 | 1,600 | 84 Veterinary Investigation officers (cattle) Kerala. | 1,510·00 (+) | 90·00 | (*a*) |
| .. | .. | 85 Vaccination against Foot & Mouth diseases, I.V.R.I. | 13,333·00 (—) | 333·00 | (*a*) |
| 5,300 | .. | 86 Veterinary Investigation Officer (cattle) Punjab. | .. | .. | .. |
| 6,000 | .. | 87 Veterinary Investigation Officer (cattle) Saurashtra & Kutch. | .. | .. | .. |
| 11,000 | .. | 88 Veterinary Investigation Officer (cattle) Rajasthan. | .. | .. | .. |
| 5,400 | .. | 89 Veterinary Investigation Officer (cattle) Mysore. | .. | .. | .. |
| 15,000 | .. | 90 Fasciolisasis in Ruminants, (Hyderabad) Andhra Pradesh. | .. | | .. |
| 6,000 | .. | 91 Sheep & Goat diseases Rajasthan. | .. | .. | .. |
| 2,270 | .. | 92 Luxation of Patella in Bovine Orissa. | .. | .. | .. |
| 46,750 | .. | 93 Investigating the possibilities of large scale manufacture of M.S. Adjutant Vaccine I.V.R.I. | .. | .. | .. |
| 10,960 | .. | 94 Investigation of the use of stabiliser in Rinderpest and Ranikhet Vaccine U.P. | .. | .. | .. |
| 9,700 | .. | 95 V.I.O. (Sheep and Goat) Hyderabad (Andhra Pradesh). | .. | .. | .. |
| 11,930 | 8,000 | 96 V.I.O. (Sheep and Goat) U.P. | 7,940·00 (+) | 60·00 | (*a*) |
| 4,000 | 1,600 | 97 A.D.I.O. Pigs Punjab. | 1,573·00 (+) | 27·00 | (*a*) |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (d) Animal Pests Diseases and Cure—*contd.* | | | |
| 5,900 | 3,700 | 98 Manufacture of Virus Vaccine Madras. | 3,630·00 | (+) 70·00 | (*a*) |
| 3,200 | 9,500 | 99 Improvement of Vaccine Madras. | 9,420·00 | (+) 80·00 | (*a*) |
| 4,500 | 4,400 | 100 Bacteriological flora of bovine genetalia, Orissa. | 4,400·00 | .. | |
| 45,780 | .. | 101 Scheme to study keeping quality of veterinary biological products I.V.R.I. | .. | .. | |
| 6,060 | .. | 102 Toxic plants and herbs lethal to domestic animals W. Bengal. | .. | .. | |
| 2,860 | .. | 103 Studies on the life history and bionomics of Ery Trema etc. W. Bengal. | .. | .. | |
| 17,500 | 9,900 | 104 Control of Brucellosis, Madras. | 9,850·00 | (+) 50·00 | (*a*) |
| 7,000 | .. | 105 Control of Brucellosis, Orissa. | .. | .. | |
| 14,000 | 10,700 | 106 Rabbies Research & Diagnostic Centre, I.V.R.I. | 10,650·00 | (+) 50·00 | (*a*) |
| 15,000 | 13,600 | 107 Parasitic disease Mysore. | 13,528·00 | (+) 72·00 | (*a*) |
| 6,000 | 2,400 | 108 Fluke disease of bovine, Mysore. | 2,400·00 | .. | |
| 16,280 | 1,200 | 109 Investigation of infectious abortion (Brucellosis) U.P. | 1,105·00 | (+) 95·00 | (*a*) |
| 20,000 | 14,000 | 110 Liver fluke and other parasitic infection of liver stock, Bihar. | 14,000·00 | .. | |
| 8,050 | 3,800 | 111 Control and eradicating of stephoonofillarises among cattle Humpsone Scheme Orissa. | 3,780·00 | (+) 20·00 | (*a*) |
| 4,000 | .. | 112 Control and eradicating of stephoonofillarises among cattle Humpsone Scheme Assam. | .. | .. | .. |
| 5,000 | 4,000 | 113 Control and eradicating of stephoonofillarises among cattle Humpsone Scheme W. Bengal. | 4,000·00 | .. | .. |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (d) Animal Pests Diseases and Cure—*contd.* | | | |
| 16,620 | .. | 114 Studies on micotic diseases in domestic animals in W. Bengal. | .. | .. | |
| 5,290 | .. | 115 Study of germicidal action of certain well-known medicines W. Bengal. | .. | .. | |
| 9,700 | 7,600 | 116 Biology and systematics of hill leeches Delhi University. | 7,600·00 | .. | |
| .. | 400 | 117 Contagious caprine pleuropneumonis I.V.R.I. | 354·00 | (+) 46·00 | (*a*) |
| 6,700 | .. | 118 Coccidal flora of Cattle, Bombay. | .. | .. | |
| 18,600 | 16,600 | 119 Bearing of nutrition of helminthic infection I.V.R.I. | 16,600·00 | .. | |
| .. | 1,400 | 120 Bearing of nutrition of helminthic infection Lucknow University. | 1,379·00 | (+) 21·00 | (*a*) |
| 35,000 | 2,000 | 121 Control of bovine pleuro-Pneumonis, Assam. | 1,966·00 | (+) 34·00 | (*a*) |
| 9,410 | — | 122 Elucidation of life history of (*i*) Parafilaria bovicola (*ii*) Setariacervi and (*iii*) Setariadigata including studies on their pathologicity and Theropensis Bihar. | .. | .. | |
| 9,300 | — | 123 Investigation of Brucellosis, Bihar. | .. | .. | |
| 6,000 | .. | 124 Experimental studies on Bovines Anaesthesia under Indian Conditions, Orissa. | .. | .. | |
| .. | .. | 125 Scheme for indigenous drugs with reference to toxicology. | 14·00 | (—) 14·00 | (*a*) |
| — | 100 | 126 Indigenous drugs of India for use in veterinary practice I.V.R.I. | 86·50 | (+) 13·50 | (*a*) |
| 4,600 | .. | 127 Lumber paralysis in Sheep and Goats, Punjab. | .. | .. | |
| 7,000 | 6,000 | 128 Lumber paralysis in Goats, Orissa. | 6,000·00 | .. | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (d) Animal Pests Diseases and Cure—*concld.* | | | |
| 5,600 | 2,900 | 129 Investigation of mastitis Bombay. | 2,886·00 | (+) 14·00 (*a*) | |
| 15,000 | 12,000 | 130 Investigation of mastitis I.V.R.I. | 12,000·00 | .. | |
| 7,000 | .. | 131 Investigation of mastitis Madras | 5,650·00 | (—) 5,650·00 | Due to error in totalling at the time of reappropriation. |
| 5,000 | 5,700 | 132 Investigation of mastitis U.P. | 8,628·00 | (—) 2,928·00 | |
| | | (e) Dairying. | | | |
| 25,000 | 23,000 | 132 Pathogenic Bacteria A I.D.R.I. | 23,000·00 | .. | |
| 20,000 | 12,000 | 133 Preparation of smatizers, I.D.R.I. | 12,000·00 | .. | |
| 26,000 | 35,000 | 134 Bacteriological quality of milk Kaira Bombay. | 35,220·00 | (+) 80·00 (*a*) | |
| 24,700 | 300 | 135 Accelerated oxidation test of ghee, I.D.R.I. | 218·00 | (+) 82·00 (*a*) | |
| 3,770 | .. | 136 Detection of adulteration and estimation of main constituents of milk, Punjab University. | — | .. | |
| 10,000 | .. | 137 Scope for the introduction of sterilized milk in India W. Bengal. | — | .. | |
| 26,270 | .. | 138 Survey of Bacteriological quality of milk, Andhra. | — | .. | |
| 55,710 | 46,000 | 139 Survey of Bacteriological quality of milk, Agricultural Instt. Allahabad. | .. 45,920·00 | .. (+) 80·00 (*a*) | |
| 22,220 | — | 140 Estimation of milk sucked by calves in unweaned herds, Andhra. | — | .. | |
| 9,000 | — | 141 Application of bacteriological test of milk, Calcutta Milk supply Scheme W. Bengal. | — | — | |
| 8,000 | .. | 142 Study of the let down response of breeds of Indian cows and buffaloes, W. Bengal. | .. | — | |
| 30,000 | .. | 143 Survey and Bacteriological quality of milk in Delhi N. D. R.I. | — | — | |
| 5,000 | .. | 144 Production of dehydrated powder and edible casein I.D.R.I. | — | — | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (f) Wool | | | |
| .. | 100 | 144 Wool analysis Bombay A University. | 49·00 (+) | 51·00 | (*a*) |
| 5,430 | 2,200 | 145 Wool analysis, Bihar. | 2,200·00 | .. | |
| 9,000 | .. | 146 Utilization of wool, U.P. | .. | .. | |
| .. | 1,500 | 147 Cost of production of Sheep and Wool, Poona | 1,431·00 (+) | 69·00 | (*a*) |
| | | (g) Skins and Hides | | | |
| 21,690 | 300 | 148 Chemistry of mineral tannages, C.L.R.I. | 15,330·00 (—) | 15,030·00 | Due to oversight this expenditure was not taken into account while surrendering amount. |
| 4,490 | 1,800 | 149 Wool utilization centre, Madras. | 1,800·00 | .. | |
| 8,490 | 100 | 150 Manufacture of fat liquors, C.L.R.I. | 38·00 (+) | 62·00 | (*a*) |
| 9,090 | 100 | 151 Manufacture of Chrome retan leather C.L.R.I. | 4,042·00 (—) | 3,942·00 | Due to mistake in totalling at the time of re-appropriation. |
| 6,080 | 100 | 152 Manufacture of leather boards. | 3,442·00 (—) | 3,342·00 | (*c*) Due to mistake in totalling at the time of re-appropriation. |
| 34,050 | .. | 153 Skin diseases of sheep (co-ordinated scheme) 3 centres. | .. | .. | |
| | | (h) Poultry | | | |
| 1,630 | .. | 154 Influence of climate on performance of Desi strain of fowl, Orissa. | .. | .. | |
| 9,000 | .. | 155 Influence of climate on performance of Desi strain of fowl, Madras. | .. | .. | |
| 4,300 | .. | 156 Influence of climate on performance of Desi strain of fowl, Travancore Cochin. | .. | .. | .. |
| 17,810 | .. | 157 Laying trials of Poultry, I.V.R.I. | .. | .. | |
| 9,720 | 2,200 | 158 Coccidiosis in Poultry, I.V.R.I. | 2,200·00 | .. | |
| 9,000 | .. | 159 Poultry Research, Travancore Cochin. | 3,539·31 (—) | 3,539·31 | (*b*) Amount was wrongly debited to Poultry Development American Mission Madras. |
| | | .. .. | | | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—contd. | | | |
| | | (h) Poultry—*contd.* | | | |
| 3,500 | 3,800 | 160 A.K.I.O. (Poultry) Andhra. | 3,750·00 (+) | 50·00 (*a*) | |
| 1,03,200 | 91,200 | 161 Poultry Development, American Mission, Madras. | 87,574·69 (+) | 3,625·31 (*k*) | A sum of Rs. 3,539·31 of Poultry Research Travancore Cochin was wrongly debited to this scheme. |
| .. | 10,000 | 162 Poultry Development, American Mission, Kerala. | 10,000·00 | .. | |
| 11,400 | 13,800 | 163 Study of Cross breeding in Poultry, Allahabad. | 13,718·00 (+) | 82·00 (*a*) | |
| 68,00 | .. | 164 Keeping poultry in Battery, W. Bengal. | .. | .. | |
| 19,240 | .. | 165 Studies on the growth rate and egg production of pure bred cross Poultry, W. Bengal. | .. | .. | |
| 11,880 | .. | 166 Economic Poultry ration, Andhra. | .. | .. | |
| 9,140 | .. | 167 Economic Poultry ration, Madras. | 3,900·00 (—) | 3,900·00 (*g*) | |
| 8,930 | .. | 168 Economic Poultry ration, Punjab. | .. | .. | |
| 11,350 | .. | 169 Defertilization of eggs I.V.R.I. | 490·69 (—) | 490·69 (*a*) | |
| 13,870 | .. | 170 Investigation of possibilities of correlation between physiology and body characteristics of egg production I.V.R.I. | .. | .. | |
| 4,220 | 3,600 | 171 Immunization of village poultry against Ranikhet diseases, Bombay. | 3,519·50 (+) | 81·00 (*a*) | |
| 7,000 | 4,000 | 172 Duck breeding, Kerala | 4,000·00 | .. | |
| 20,000 | 9,000 | 173 Duck breeding, I.V.R.I. | 9,000·00 | .. | |
| | | (i) Fish | | | |
| .. | 8,000 | 173 Rural pisciculture, A Madras. | 7,976·00 (+) | 24·00 (*a*) | |
| 9,580 | .. | 174 Processing of unpopular fish, W. Bengal. | .. | .. | |

APPENDIX XVI—*contd.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*ii*) *Animal Husbandry*—concld. | | | |
| | | (i) Fish—*contd.* | | | |
| 5,990 | .. | 175 Study of microfial flora-fresh water fish from Bay of Bengal, W. Bengal. | .. | .. | |
| 4,000 | 2,800 | 176 Improvement of Craft and tackle in fishing, Orissa. | 2,797·00 (+) | 3·00 | (*a*) |
| 14,200 | .. | 177 Hydro-trological and Fanistic Survey of the Godavari Estuarine system Andhra University. | .. | .. | |
| 9,400 | 18,500 | 178 Ecology of fresh water fish in U.P., Lucknow University. | 18,440·00 (+) | 10·00 | (*a*) |
| | | (j) Apiculture | | | |
| 6,000 | 2,700 | 178A Ecology of fresh water fish in Madras. | 2,700·00 | | |
| 3,400 | .. | 179 Studies on Bee-flora, Coorg. | .. | .. | |
| | | (k) Miscellaneous | | | |
| 4,150 (*b*) | .. | 180 Training course in live stock marketing AMA's office. | .. | .. | |
| 12,770 | 5,300 | 181 Award of fellowships in A.H. subjects, I.V.R.I. | 11,274·74 (—) | 5,974·74 | Due to mistake in totalling at the time of re-appropriation. |
| 460 | .. | 182 Award of fellowships in dairying, I.D.R.I. | .. | .. | |
| 6,700 | .. | 183 Diploma course in Swine Husbandry and pork processing at Central Dairy Farm, Aligarh U.P. | .. | .. | |
| 6,330 | .. | 184 Using cow for work I.V.R.I. | 4,700·00 (—) | 4,700·00 | (*g*) |
| 6,500 | .. | 185 Post graduate course in parasitology Madras. | 2,500·00 (—) | 2,500·00 | (*g*) |
| | | (*iii*) *Combined Agriculture and A. H. Schemes* | | | |
| | | (a) Development | | | |
| 6,990 | 2,800 | 1 Production and trial of agriculture implements, I.A.R.I. | 2,740·00 (+) | 60·00 | (*a*) |
| .. | 2,000 | 2 Refresher Course in Agriculture for young farmers, Amravati. | 2,000·00 | .. | .. |

APPENDIX XVI—*concld.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | C—*Grants-in-aid*—contd. | | | |
| | | (*iii*) *Combined Agriculture and A. H. Schemes*—contd. | | | |
| | | (a) Development—*contd.* | | | |
| .. | 100 | 3 Refresher Course in Agriculture for young farmers, Bihar. | 87·00 (+) | 13·00 (*a*) | |
| 600 | .. | 4 Refresher Course in Agriculture for young farmers, Saurashtra. | .. | .. | |
| 6,240 | .. | 5 Refresher Course in Agriculture for young farmers, Hyderabad. | .. | .. | |
| 5,750 | .. | 6 Refresher Course in Agriculture for young farmers, Madras. | .. | .. | |
| .. | 4,200 | 7 Research fellowships in Agriculture, Instt. of Agri. Anand. | 4,200·00 | .. | |
| 3,770 | .. | 8 Research followships in Agric lture School of Econ. & Sociology, Bombay. | .. | .. | |
| 3,200 | 200 | 9 Research followships in Agriculture College Baptala, Andhra. | 150·00 (+) | 50·00 (*a*) | |
| 3,200 | .. | 10 Research followships in Agriculture Sugarcane breeding Instt. & College, Coimbatore. | .. | .. | |
| .. | .. | 11 Research followships in Agriculture Sugarcane breeding Instt. & College, I.A.R.I. | 6,380·00 (—) | 6,380·00 (*g*) | |
| 1,550 | 12,900 | 12 Survey of Indigenous Implements, I.A.R.I. | 12,890·00 (+) | 10·00 (*a*) | |
| .. | 100 | 13 Survey of Indigenous Implements, Punjab. | 108·00 (—) | 8·00 (*a*) | |
| .. | 1,800 | 14 Survey of Indigenous Implements, Bombay | 1,727·00 (+) | 73·00 (*a*) | |
| .. | 200 | 15 Survey of Indigenous Implements, Kerala. | .. (+) | 200·00 (*a*) | |
| 3,960 | 8,200 | 16 Research fellowships in Agriculture Govt. Agri. College, Kanpur (U.P.) | 8,130·00 (+) | 70·00 (*a*) | |
| 1,00,000 | 4,500 | 17 Research fellowships in Agriculture Govt. Agri. College, other states. | 4,485·00 (+) | 15·00 (*a*) | |
| .. | .. | 18 Survey of indigenous implements Pepsu (Punjab). | 172·25 (—) | 172·25 (*a*) | |
| .. | .. | 19 Survey of indigenous implements H. P. | 81·62 (—) | 81·62 (*a*) | |

APPENDIX XVI—*contd.*

| 1 | 2 | | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | | | C—*Grant-in-aid*—concld. | | | |
| | | | (*v*) *Miscellaneous Schemes* | | | |
| .. | .. | 1 | Livestock and fishery Statistics Madras. | 12,315·00 (—) | 12315·00 | (*g*) due to over sight this expenditure was not taken into account while surrendering amount. |
| .. | .. | 2 | Livestock and fishery Statistics Bombay. | 1,015·00 (—) | 1015·00 | |
| .. | 23,000 | 3 | Method and Practice of Farm Accounts, Gokhale Institute. | 23,000·00 | .. | |
| 20,000 | .. | 4 | Scheme for studying the intensive cultural practice in small holding Calcutta University. | .. | .. | |
| 26,250 | .. | 5 | Pilot sample investigation practices and yield on orange crops, M.P. | .. | .. | |
| .. | 10 | 6 | Cost of production of sheep and wool, Poona. | 2·00 (+) | 8·00 | (*a*) |
| (g) 11,470 | .. | 7 | Pilot sample investigation and the cultivation practices and yield in Mango crop, U.P. | .. | .. | |
| (g) 3,830 | .. | 8 | Investigation on parity practices of Rice & Jute Visva Bharti. | .. | .. | |
| 11,870 | 200 | 9 | Study on mechanised farming, Benaras Hindu University. | 200·00 | .. | |
| 5,000 | .. | 10 | Study of farm and Nonfarm employment in South Arcot District, Anamalai University. | .. | .. | |
| .. | .. | 11 | Sugarcane Production Pepsu (Punjab). | (—) 1,100·00 | .. | The amount sent to Punjab Govt. has been returned to I.C.A.R. due to less expdr. on scheme and refunded to Govt. of India vide Vr. 999(6)/11/58 |
| .. | .. | 12 | Pilot Sample Survey, pepper, Kerala. | 6,056·00 (—) | 6,056·00 | Due to over sight this expenditure was not taken into account while surrendering. |

APPENDIX XVI—*concld.*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | *D—Contributions to Institutions* | | | |
| 37,300 | 37,300 | 1 Commonwealth Agricultural Bureaux. Imperial Institute of Mycology. Imperial Institute of Entomology. Farnham House Laboratory. Imperial Bureaux of Dairy Science. Fruit Preservation Research Station, Campden. | 37,250·00 | (+) 50·00 | (*a*) |
| | | *Debts and Remittances* | | | |
| 10,000 | 10,700 | 1 Loans and Advances | 10,668·00 | (+) 32·00 | (*a*) |
| 1,000,00 | 68,800 | 2 Deposits & Advances repayable. | 57,983·76 | (+) 10816·24 | (*a*) |
| 1,01,000 | 19,700 | 3 Payment of Income Tax, Provident Fund Etc., | 30,069·86 | (+) 10369·86 | (*a*) |
| 12,50,820 | .. | (*i*) Total Standing Charges | 8,06,869·98 | .. | |
| 39,09,320 | .. | (*ii*) Total Research etc. under direct control of ICAR. | 33,10,129·80 | | |
| 81,29,770 | .. | (*iii*) Total Grants-in-aid | 35,22,954·78 | .. | |
| .. | .. | (*iv*) Total contributions | 37,250·00 | .. | |
| 2,11,000 | .. | (*v*) Total Debts and Remittances. | 98,721·62 | .. | |
| | | Total .. | 77,75,926·18 | .. | |
| | | Investment and Reinvestments. | 69,76,200·00 | | |
| | | *Closing Balances* | | | |
| | | (*i*) Cash Balance .. | 2,903·99 | .. | |
| | | (*ii*) Bank Balance .. | 21,46,352·93 | .. | |
| | | (*iii*) Provident Fund .. | 36,246·62 | .. | |
| | | Total .. | 21,85,503·54 | 21,85,503·54 | |
| | | Total .. | .. | 1,69,37,629·72 | |

Certified that the above accounts have been audited and found correct subject to remarks in the Inspection Report.

Sd. H. R. Tandon
*Assistant Accounts Officer,*
*Central Revenues*

Sd. B. S. Ramdas
*Under Secretary*
*Indian Council of Agricultural Research*
*Krishi Bhavan. New Delhi*

APPENDIX 'A'

1957-58

*Details of Advance—*

*I.* Permanent advance with the Additional Secretary. Rs. 500

| *II. Particulars of Securities from General Account—* | Face Value | Purchase Value | Market Value |
|---|---|---|---|
| 1. 3% Victory Loan 1959-61 .. | 5,00,000 | 5,03,125·00 | 4,5,9250·00 |
| 2. 3% Stock 1963-65 .. .. | 16,49,500 | 15,54,334·00 | 15,60,427·00 |
| 3. 2¾ Stock 1962— | | | |
| (*i*) .. .. .. | 4,00,000 | 4,02,736·56 | 3,80,000·00 |
| (*ii*) .. .. .. | 5,50,000 | 5,50,900·00 | 5,22,500·00 |
| 4. 3% Loan 1970-75 .. .. | 63,09,400 | 54,90,882·02 | 54,41,857·00 |
| 5. 3½% N. P. Bond 1961 .. .. | 10,11, 400 | 10,00,000·00 | 10,07,860·00 |
| 6. 3¾% Loan 1974 .. .. | 35,53,200 | 34,90,902·00 | 34,89,242·00 |
| 7. 4% Loan 1972 .. .. .. | 18,56,200 | 18,56,200·00 | 18,58,984·00 |
| 8. Ten short term deposit receipts No. A000596 to A000605 repayable at a week's notice. | 10,00,000 | 10,00,000·00 | 10,00,000·00 |
| 9. Forty three short term deposit receipts No. A001102 to A001144. | 21,50,000 | 21,50,000·00 | 21,50,000·00 |
| 10. Sixteen fixed deposit receipts No. F55990 to F56005. | 16,00,000 | 16,00,000·00 | 16,00,000·00 |
| 11. Six fixed deposit receipts No. F56261 to F 56266. | 6,00,000 | 6,00,000·00 | 6,00,000·00 |
| Total .. .. | 2,11,79, 700 | | |

| *III. Particulars of Securities from Provident fund Account—* | | | |
|---|---|---|---|
| 1. 12 Year National Savings certificates No. N. S./F087031 to 087035, 087031. | 50,000 | 50,000·00 | 50,000·00 |
| 2. 12 Year National Savings certificates No. NS 029496, 029497, 063601 to 063610. | 60,000 | 60,000·00 | 60,000·00 |
| 3. 12 Year National Savings certificates No. NS./F087258 to 087263. | 30,000 | 30,000·00 | 30,000·00 |
| 4. 3½% National Plan Loan 1964 Safe Custody receipt No. DH 295. | 35,000 | 34,606·25 | 34,600·00 |
| 5. 3½% National Plan Loan 1964 Safe Custody receipt No. DH 296. | 15,000 | 14,838·28 | 14,838·00 |
| 6. 12 Year National Savings certificates Nos. 0113337 to 113346. | 50,000 | 50,000·00 | 50,000·00 |
| 7 Short term deposit receipts No. F22389 payable at a week's notice. | 20,000 | 20,000·00 | 20,000·00 |
| 8. 12 Year National Savings certificates Nos. F087126 and 0110921 to 110931. | 60,000 | 60,000·00 | 60,000·00 |
| 9. 12 Year National Savings certificates Nos. 0015275 to 0015288. | 70,000 | 70,000·00 | 70,000·00 |
| | 3,90,000 | | |

| Total Securities— | |
|---|---|
| (*i*) General Account .. .. | 2,11,79,700 |
| (*ii*) Provident Fund Account .. | 3,90,000 |
| | 2,15,69,700 |

APPENDIX 'B'

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

*Statement of Income and Expenditure for the year 1957 58*

| | | |
|---|---|---|
| **RECEIPTS—** | | |
| 1. Opening Balance | | 23,71,317·46 |
| 2. Receipts under Agricultural Produce Cess Act | | 39,79,234·46 |
| 3. *Contribution and Grants—* | | |
| (*a*) Contribution from Constituent States | 3,05,750·00 | |
| (*b*) From Central Government | 7,54,528·61 | |
| (*c*) From other sources | 1,15,000·00 | |
| | | 11,75,278·61 |
| 4. Interest on Investments | | 5,98,525·07 |
| 5. Miscellaneous receipts | | 7,71,793·87 |
| 6. E. Debts and Remittances | | 1,35,280·25 |
| 7. Investments and Re-investments | | 79,06,200·00 |
| Total | | 1,69,37,629·72 |
| 1. Opening Balance | | 23,71,317·46 |
| 2. Receipts during the year | | 66,60,112·26 |
| 3. Investments and Re-investments | | 79,06,200·00 |
| Total | | 1,69,37,629·72 |
| **PAYMENTS—** | | |
| 1. *Headquarter Schemes—* | | |
| (*a*) Standing Charges | 8,06,869·98 | |
| (*b*) Agriculture | 7,26,936·83 | |
| (*c*) Animal Husbandry | 98,167·22 | |
| (*d*) Miscellaneous | 24,85,025·75 | |
| | | 41,16,999·78 |
| 2. *Grant-in-aid—* | | |
| (*a*) Agriculture Schemes | 22,24,794·65 | |
| (*b*) A. H. Schemes | 12,13,521·26 | |
| (*c*) Combined Agricultural & A. H. | 43,150·87 | |
| (*d*) Miscellaneous | 41,488·00 | |
| | | 35,22,954·78 |
| 3. Total contribution to various Institutions | | 37,250·00 |
| 4. Debts and Remittances | | 98,721·62 |
| 5. Investments and Re-investments (Face Value) | | 6,97,76,200·00 |
| 6. Closing Balances | | 21,85,503·54 |
| Total | | 1,69,37,629·72 |
| 1. Payments during the year | | 77,55,926·18 |
| 2. Investments and reinvestments | | 69,76,200·00 |
| 3. Closing Balances on 31-3-58 | | 21,85,503·54 |
| | | 1,69,37,629·72 |

Sd. B. S. Ramdas
*Under Secretary*
*Indian Council of Agricultural Research*

Test checked and found correct subject to the remarks in the Inspection Report.

Sd. H. R. Tandon
*Assistant Accounts Officer,*
*Central Revenue*
*New Delhi*

*Particulars of Closing Balance—*

| | | |
|---|---|---|
| (*i*) Cash in hand .. .. .. .. .. | 2,903,99 | |
| (*ii*) Cash in hand (General Account) .. .. .. | 21,46,352·93 | |
| (*iii*) Provident fund Account Balance .. .. | 36,246·62 | 21,85,503·54 |

*Financial position (Assests) of the Council as on 31-3-1955—*

| | |
|---|---|
| 1. Closing Balance as detailed above .. .. .. | 21,85,503·54 |
| 2. Face Value of Securities .. .. .. .. | 2,15,69,700·00 |
| 3. Cash in hand with Additional Secy. (Imprest Accounts) .. .. .. .. | 500·00 |
| Grand Total .. | 2,37,55,703·54 |

Sd. B. S. Ramdas
*Under Secretary*
*Indian Council of Agricultural Research*

Test checked and found correct subject to the remarks in the Inspection Report.

Sd. H. R. Tandon
*Assistant Accounts Officer,*
*Central Revenues,*
*New Delhi*

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